Metals Review

THE NEWS DIGEST MAGAZINE

Volume XXIV—No. 6 June, 1951

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NATIONAL METAL EXPOSITION

Detroit, Michigan **Week of October 15-19, 1951**

"Detroit Means Business"

Metals Review

THE NEWS DIGEST MAGAZINE

VOLUME XXIV, No. 6 **JUNE, 1951**

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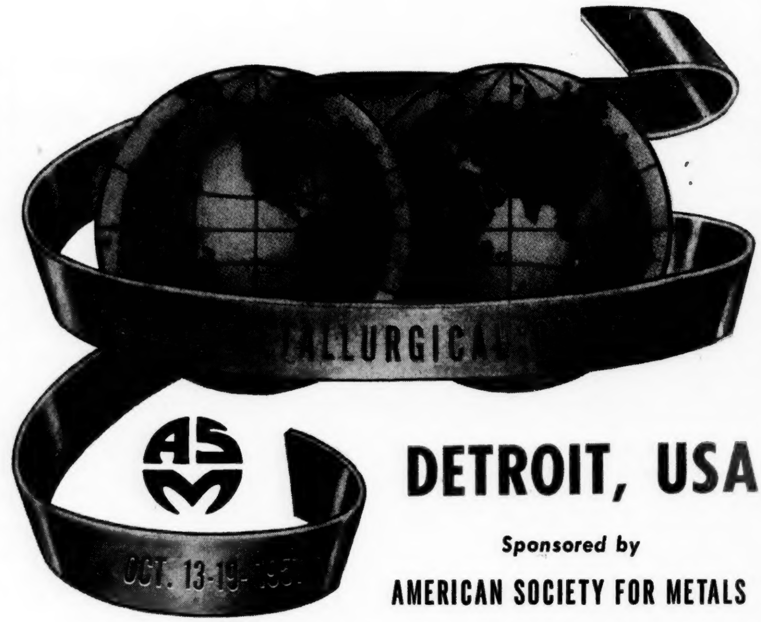
WORLD METALLURGICAL FIRST INTERNATIONAL



DETROIT, USA

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AMERICAN SOCIETY FOR METALS

METAL RESOURCES, upon which rest the security and freedom of the world, will be thoroughly discussed by top-ranking metal scientists and engineers from the free nations of Europe, Africa and Asia, as well as from North and South America when they gather in Detroit, Oct. 14 through 19 to attend the World Metallurgical Congress, first international conclave of its kind.

More than 500 "conferees" from upwards of 20 freedom-loving countries will assemble for an "exchange of ideas." They will join with thousands of American metallurgists who will participate in the World Metallurgical Congress, according to Walter E. Jominy of Detroit, staff engineer of the Chrysler Corp. and president of the American Society for Metals. A.S.M., the "engineering society of the metal industries," is sponsoring the world scientific meeting concurrently with the 33rd annual National Metal Congress and Exposition.

In announcing the World Metallurgical Congress, Jominy pointed out that the full support of the Economic Cooperation Administration of Washington, D. C., has been extended. A technical assistance program covering visits of "delegations of metal scientists" from ECA countries has been established by the economic agency as the result of a request from the Organization for European Economic Cooperation. It is by far the largest technical assistance program yet undertaken by the ECA.

Activities Cover Five Weeks

The foreign visitors, known as "conferees," are to arrive about Sept. 15. They will spend approximately five weeks in the United States. During the first four, they will be divided into eight groups participating in a series of study tours to industrial, government and educational institutions to observe at first hand the scientific, industrial and educational advances that have taken place in this country during the past few years. Some 150 plants in 13 states and 57 cities are to be visited.

By action of the Board of Trustees of the American Society for Metals, Dr. Zay Jeffries of Pittsfield, Mass., retired vice-president of General Electric Co., a past president of the American Society for Metals, a world-renowned author, scientist and a member of the National Academy of Sciences, has been appointed Director General of the World Metallurgical Congress.

Dr. Jeffries, affectionately known as "the dean of American metallurgists," will help shape the program of the Congress, especially as it relates to world metal resources.

Returning in May from an extended European trip, Dr. Jeffries reported "enthusiasm" for the World Congress by governmental, industrial and scientific leaders with whom he conferred. Facilitating Dr. Jeffries' trip were the Washington ambassadors of all the free countries concerned with metals, to whom invitations had been addressed asking their assistance in the appointment of conferees. In like manner, the American Embassies abroad "rendered valuable help" according to Jeffries.

Free World Friendships

Mindful of the free world's desire for continued peace, Dr. Jeffries stated recently that "the only way people can have peace with freedom in this troubled world is to be strong. Strength insures a high standard of living. There is no way to divorce our standard of living and our military potential from a healthy metal industry." He pointed out that the time has come for us "to wage peace with industrial strength."

The World Metallurgical Congress is expected to further international understanding, say its leaders. It will provide broad opportunities for the interchange of ideas among scientists "that will bear on more efficient production for defense that ultimately means freedom and peace."

Early in the Congress a comprehensive summary of raw materials of the world as they relate to the metal industry will be presented. Visiting authorities from European and other free countries, Canada and the United States will discuss problems of "conservation, utilization and substitution of strategic metals". According to Dr. Jeffries, "metallurgists can be counted on for efficient utilization so essential in making optimum use of all metals". This could enhance the potential military power of the free peoples to such a degree as to deter any "aggressive attack".

Industrial Study Tours

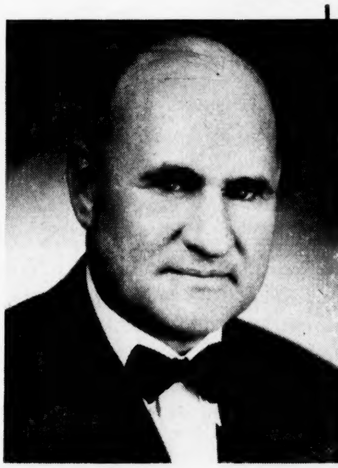
The industrial study tours planned for the visiting scientists and metal executives are being arranged in eight categories of the metal industry, namely: (1) steelmaking and

CONGRESS TO BE THE EVENT OF ITS KIND

refining; (2) nonferrous refining, rolling and fabrication (copper, brass, bronze, aluminum, magnesium); (3) ferrous rolling, forging and hot work in steel mills and heavy industry; (4) stamping, cold work, machining and finishing in lighter industry; (5) heat treatment; (6) welding and joining; (7) inspection and testing; and (8) research, engineering societies and universities.

In Detroit, visiting conferees will each have an "opposite number"—an American whose technical, scientific or business interest closely parallels his own. They will meet in special session in Detroit to exchange ideas and present scientific papers dealing wtih metals.

Information concerning the World Metallurgical Congress can be procured from its sponsor, the American Society for Metals, Wm. H. Eisenman, Secretary, 7301 Euclid Avenue, Cleveland 3, Ohio.



Zay Jeffries
Director-General, W.M.C.

Walter Jominy
President, A.S.M.

Present Moly High Speed Steels Contrasted With Poor Wartime Substitutes

Reported by Knox A. Powell
Minneapolis-Moline Co.

The frequently poor performance of the molybdenum high speed substitute steels during the last war was contrasted with the good performance to be expected of the present molybdenum steels for the benefit of Northwest Chapter members on April 19. Charles Saenger, general foreman of heat treating and forging, Illinois Tool Works, spoke on "Relative Merits of Moly and Tungsten High Speed Steels."

The high speed steel which characterized the substitutes of the last war contained 8½% molybdenum, replacing all but 1% of the tungsten in the regular 18-4-1 W-Cr-V steel. It was especially difficult to heat treat. A steel containing 5% Mo, 4% Cr, 2% V, and 6% W came in toward the end of the war with an increased percentage of tungsten salvaged from tungsten high speed scrap. It was easier to heat treat without decarburization, although the quenching range was still restricted to half that of regular tungsten high speed steel.

Closer control of temperatures and atmospheres in heat treating equipment since the war, said Mr. Saenger, has still further improved the medium tungsten moly high speed steel so that its performance is equal to or better than the 18-4-1 analysis.

The higher vanadium in this steel actually increases its toughness and wear resistance over ordinary tungsten high speed, said Mr. Saenger. An interesting moly high speed with vanadium still further increased to 4½% hardens readily to Rockwell C-66. It has high abrasion resistance although less toughness than the 2% vanadium steels.

Surface treatments such as nitriding to a depth of approximately 0.0005 in. reduce the surface coefficient of friction and galling for low-clearance applications. Blasting with 2500-mesh grit also lowers the coefficient of friction. Oxide coatings retain lubricant and resist corrosion. Sub-zero temperature treatments tend to stabilize dimensions and relieve locked-in stresses but do not improve structures of high speed steels that have been properly heat treated, said Mr. Saenger.

In an interesting discussion it was brought out that critically restricted cobalt apparently has no substitute for red hardness characteristics.

Course in Spectrography

Boston College has announced a special two weeks intensive course in "Modern Industrial Spectrography" from July 23 to Aug. 3. The course is particularly designed for chemists and physicists from industries in the process of installing spectrographic equipment. Information on the course can be obtained from Prof. James J. Devlin, Physics Department, Boston College, Chestnut Hill, Boston 67, Mass.

Free Folder Describes Career in Metallurgy

The facts about a career in metallurgy are outlined in an informative folder recently published by the American Society for Metals. The folder is designed to describe the work of a metallurgist and to present some of the sound advantages for a young man selecting metallurgy as a career.

Starting with a definition of metallurgical engineering, the booklet stresses the importance, interest and expanding opportunities of the profession. Abundant evidence of successful careers in this field is included. A list of typical firms employing metallurgists is given, together with a list of 61 colleges and universities offering metallurgical courses.

The folder was prepared under the direction of the A.S.M. Advisory Committee on Metallurgical Education. Copies of "A Career in Metallurgy" are available at no charge from American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.

Waste Disposal Plants Increasingly Neccessary in Industry, Chapter Told

Reported by Walter C. Struchen
Chemist, Erie Forge Co.

"What does the problem of industrial waste disposal mean to your plant?" was the challenging question put before the members of the Northwestern Pennsylvania Chapter A.S.M. at a meeting on March 15. The speaker was Harry W. McElhaney of Talon, Inc.

Huge volumes of water are needed for industrial use, ranging from 320,000 gal. to make one ton of rubber to two quarts to make one small talon slide fastener, the speaker pointed out.

It is becoming increasingly clear that industry must spend money to prevent contamination of water from its waste products. The laggards will be legislated into such action in the near future. A company that does not now have a waste disposal system must expect to build, maintain, staff, buy chemicals, and in other ways expend large sums of money. Returns for such an investment lie in greater attention to economical operation and reduced cost of waste disposal through the salvage of valuable materials now being lost.

Before installing a waste disposal plant, a thorough survey should be undertaken. Volume of waste to be handled, its concentration, the occurrence of slugs, layout of all drains, sewers and water lines, pipe sizes, and direction and rate of flow must be analyzed.

Two systems of industrial waste disposal are in common use—the batch system, and the continuous flow system. The batch system is completely controlled at all times and is highly desirable. The continuous flow system is less desirable because of surges and the human element in control. However, in special cases, it can be used. The system best suited to the individual plant is determined only through careful research and the use of a pilot plant. Know your district engineer well and work with him, Mr. McElhaney admonished.

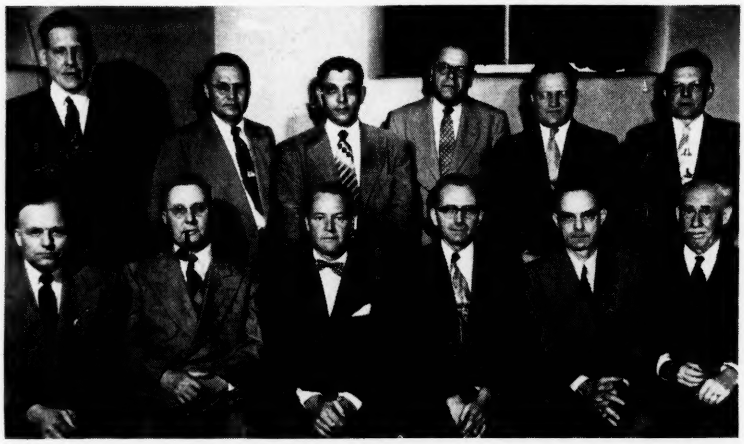
The main industrial wastes are acid, acid plus toxic metals, cyanide, oil, phenols, and resultant sludges. Acid wastes are best treated by simple liming. The amount of lime is carefully calculated. The clear liquid is then decanted and the sludge is allowed to settle. Caustic soda may be used instead of lime. Where chromium is present, a preliminary treatment with some material such as ferrous sulphate or sodium bisulfite is necessary, followed by treatment with lime.

At least ten methods are in use for the treatment of cyanides, but some of them are only partial treatments. Dilution with water is a means of disposal and is very dangerous. The chlorination process is a good method, and gives complete destruction if carried to completion.

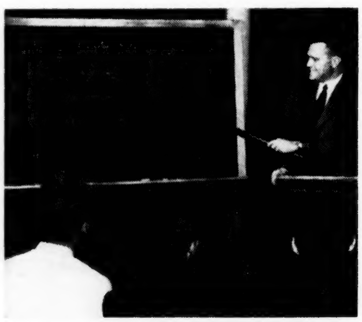
When a waste disposal plant is installed, it should be designed to allow for considerable expansion. The responsibility for its operation should be put into the hands of one man and no one should be permitted to interfere with his authority. Mr. McElhaney illustrated his talk with detailed slides showing the large waste disposal plant of Talon, Inc.

DON'T MISS—
World Metallurgical Congress
National Metal Congress
National Metal Exposition
Detroit—Oct. 15 to 19, 1951

Columbus Honors Sustaining Members



Representatives of Sustaining Memberships Were Honored by the Columbus Chapter on May 2. Standing are F. A. Wedberg, North American Aviation, Inc.; K. W. Kayner, Industrial Furnace Supply Co.; J. D. Renollet, Columbus Steel Treating Co.; D. L. Kuhns, National Heat Treating Service Co., Inc.; G. N. Krouse, Krouse Testing Machine Co.; and O. D. Rickly, L. H. Marshall Co. Seated are W. D. Kramer, Timken Roller Bearing Co.; S. Z. Krumm, Buckeye Steel Castings Co.; R. M. Rex, Columbus Bolt & Forging Co.; C. S. Thomas, Jeffrey Mfg. Co.; R. H. Frank, Bonney-Floyd Co.; and Oscar E. Harder, Battelle Memorial Institute



Technical Speaker George A. Roberts Gives a Blackboard Demonstration of Tool and Die Steel Types

Reported by R. E. Christin
Chief Metallurgist
Columbus Bolt & Forging Co.

A word of thanks to the Columbus Chapter for the many benefits which industry has derived from A.S.M. was an unusual and impressive feature of Sustaining Members' Night held May 2. R. M. Rex, president of Columbus Bolt & Forging Co., stated that his company receives more benefit from A.S.M. than from any other organization which it supports.* Representatives of 12 of the chapter's 16 sustaining members were present at the meeting.

George A. Roberts, chief metallurgist of Vanadium-Alloys Steel Co., was the principal speaker. He highlighted his talk on tool and die steels with a discussion on alloy powdered metals of many analyses. Stainless steel compacts, he said, can be produced with an elongation in 1 in. of 35% and tensile strength of 90,000 psi. after sintering and coining.

The talk provoked active discussion among the listeners, covering such points as grinding of the highly alloyed steels, decarburization, machining, wear resistance, and other problems experienced in the use of tools and dies.

Election of officers followed the dinner, with Howard Cross, chairman of the Nominating Committee, announcing the slate. The names will be published in the August issue.

*Dr. Roberts, the guest speaker, was so impressed with Mr. Rex's enthusiasm that he invited him to come to Pittsburgh to give a similar talk.

Nominations of National Officers Announced

G. A. Roberts
For Trustee

R. L. Wilson
For Vice-President

John Chipman
For President

R. L. Dowdell
For Treasurer

J. B. Johnson
For Trustee

Nominations for new national officers of the American Society for Metals have been announced by the Nominating Committee, which met in Chicago on May 17 under the chairmanship of Karl L. Fetters, special metallurgical engineer of Youngstown Sheet & Tube Co.

John Chipman, currently serving as vice-president, was nominated for president, and Ralph L. Wilson, the present treasurer, has been selected as nominee for vice-president. Dr. Chipman is head of the department of metallurgy at Massachusetts Institute of Technology, and Mr. Wilson is director of metallurgy of the Steel and Tube Division, Timken Roller Bearing Co.

To fill the treasurer's post the committee has selected Ralph L. Dowdell, head of the department of metallurgy at University of Minnesota. Two additions proposed for the Board of Trustees are George A. Roberts, chief metallurgist, Vanadium-Alloys Steel Co., Latrobe, Pa., and J. B. Johnson, head of the metallurgical group of the Flight Research Laboratory, Wright-Patterson Air Force Base, Dayton, Ohio.

In accordance with the Constitution of the American Society for Metals, additional nominations for any of these posts may be made by written communications addressed to the secretary of the Society and signed by any 50 members. If no such additional nominations are received prior to July 15, nominations shall be closed and at the annual meeting in October 1951 the secretary will cast the unanimous vote of the members for these candidates.

An authority on steelmaking reactions and high-temperature equilibria, Dr. Chipman has devoted most of his career to academic teaching and research, with the exception of the years 1934 to 1937, when he was associate director of the research laboratories of the American Rolling Mill Co. He received his Ph.D. from University of California in 1926, was assistant professor of chemistry at Georgia School of Technology, 1926-29, and research engineer at University of Michigan, 1929-34. He received the degree of Sc.D. from the University of the South in 1940.

During the war years of 1943-44, Dr. Chipman was chief of the metallurgy section, University of Chicago, and associate director of the technical division (part of Manhattan Project, U. S. Army). Except for these two years, he has been on the staff of M.I.T. since 1937, and was appointed head of the department in 1946.

He presented the A.S.M. Campbell Memorial Lecture in 1942 and holds the Henry Marion Howe Medal for one of the best papers published in the Society's annual *Transactions*.

Mr. Wilson, the nominee for vice-president, is a 1921 graduate of Lehigh University. His experience includes six years with the metallurgical departments of the United Alloy Steel Corp. and Central Alloy Steel Corp., after which he was for ten years metallurgical engineer for Timken Steel and Tube Division.

In 1937 he joined the staff of Climax Molybdenum Co., and then served during the war as chief of the constructional steels section of the metallurgical and conservation branch, War Production Board. He rejoined Timken as chief metallurgist in 1944. Mr. Wilson served on the A.S.M. Board of Trustees in 1938-39.

Ralph L. Dowdell, selected by the committee for treasurer, was graduated from the School of Mines and Metallurgy, University of Minnesota, in 1918 and, with the exception of two brief interludes, has been on the faculty of that university ever since. After graduation, he worked with the U. S. Bureau of Mines as assistant metallurgical engineer on the so-called "Manganese War Problem" for several months before returning to Minnesota, and in 1929 he was granted a leave of absence to serve a brief period as senior metallurgist for the U. S. Bureau of Standards, where he was section chief in charge of the thermal section.

Starting at University of Minnesota in 1918 as instructor in metallurgy, he was made an assistant professor in 1926, and full professor and head of the department of metallography in 1930. He has been head of the department of metallurgy since 1944.

A frequent contributor to A.S.M. technical sessions, he is a past chairman of the Metals Handbook Committee and also of the North West Chapter.

George A. Roberts, widely known as co-author of the highly popular A.S.M. text on "Tool Steels", is a product of Carnegie Institute of Technology. After attending the U. S. Naval Academy from 1935 to 1937, he received his B.S. from Carnegie Tech in 1939. Continuing on as a teaching assistant, he earned his M.S. in 1941, and then entered the employ of Vanadium-Alloys Steel Co., and was granted a graduate fellowship at Carnegie Tech, which led to his D.Sc. degree in 1942.

He then returned to Vanadium-Alloys as research metallurgist and was appointed chief metallurgist in 1945. He is a past chairman of the Pittsburgh Chapter A.S.M.

The second nominee for trustee, J. B. Johnson, is a graduate of Cornell University with a B.S. degree in Mechanical Engineering. From 1914 to 1916 he was an inspector for the New York Central Railroad, and in 1916 joined the Aviation Section of the Signal Corps attached to the National Bureau of Standards. In 1918 he went to McCook Field in Dayton and formed the nucleus of what is now the materials laboratory. He was chief of this materials laboratory for 25 years until two years ago, when he was appointed head of the metallurgy group at the base.

Mr. Johnson has long been active in A.S.M. affairs and has served as chairman of the Metals Handbook Committee since 1948.

Steel Industry Presents Challenge to Students

Professor McFarland (Left) Presents the Award That Bears His Name to J. L. Mauthe, President of Youngstown Sheet and Tube Co.

Reported by Michael J. Mianulli
Mgr., Customer Service Div.
Titan Metal Mfg. Co.

The third annual David Ford McFarland Award was presented to J. L. Mauthe, president of the Youngstown Sheet and Tube Co., at a banquet meeting of the Penn State Chapter A.S.M. on May 4. Professor McFarland of Penn State College, in whose honor the award was established, presented a hand-lettered certificate to Mr. Mauthe.

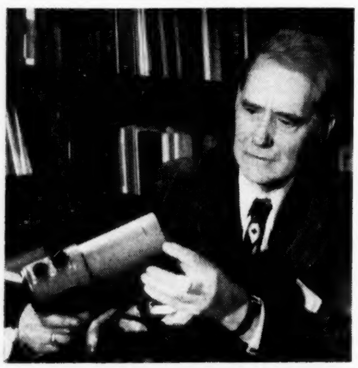
Mr. Mauthe then gave a vivid address on "Economics and Engineering for Production of Modern Steels". Technological advancements in methods are needed more today than ever before in the history of the steel industry, he said. The depletion of high-grade ores, high costs of materials, and high coal mining and coke manufacturing costs challenge the ingenuity of student metallurgists about to enter industry. These challenges must be met for successful economic survival and future world supremacy.

Collaboration in industry between electrical, mechanical, civil and metallurgical engineers is likewise a necessary factor, the speaker emphasized. Ambitious young engineers are greatly in demand, he pointed out, and in order to have a clear objective, they must have knowledge of the economics and long-range planning of the steel industry.

The effects of the federal income tax structure and depreciation restrictions on the welfare of the industry were clearly explained and illustrated by many actual facts and figures. More production per man-hour through research and development, which must provide improved techniques and methods, is the key to successful expansion, he concluded.

A lively discussion by other distinguished members of A.S.M. followed Mr. Mauthe's frank presentation, and testified to how clearly he pictured the future that faces us.

Wins Alumni Award



Ernest E. Thum, editor of Metal Progress *since its establishment in 1930, was presented with a Distinguished Service Award for Achievement in Mineral Engineering by Colorado School of Mines at the graduation exercises on May 25.*

Mr. Thum is shown here examining an improved model of a radiation counter in the Washington offices of the Atomic Energy Commission. He has served during the past two years as chairman of a special advisory committee to the Atomic Energy Commission, whose function has been to recommend technological information from the Commission's files that might be declassified for publication in the technical press.

Current Problems in a Number of Categories Probed by Dr. Kinzel

Reported by Dawn D. Whyte

Current progress and problems in industrial metallurgy formed the subject of an informative discussion before the Los Alamos Chapter of A.S.M. in April. Augustus B. Kinzel, president of the Union Carbide and Carbon Research Laboratories and vice-president of the Electro Metallurgical Division of the Corporation, was the speaker. Selecting a number of categories in iron and steel, Dr. Kinzel mentioned the problems encountered and progress toward their solutions.

Problems met in cast iron, he said, are concerned with methods to increase ductility and strength. Ductility is increased by the graphite control route. This is accomplished by eliminating or "tying up" essentially all the sulphur and, by adding calcium or magnesium. Strength may be improved by inoculation of the melt in the ladle with a deoxidizer—essentially calcium or zirconium.

In structural steels, addition of vanadium helps prevent strain aging, probably by tying up the nitrogen. Since enough capacity does not exist at present in the special facilities required for killed steel, new alloys utilizing normal manganese and about 0.05% vanadium have been prepared. Although these steels are not killed, strain aging is eliminated and fine grain is obtained.

Because almost double the quantity of heat treatable steels is being used today as compared to some years ago, a real shortage of certain alloying elements exists. To alleviate this shortage, a new series of steels using more abundant alloying metals is being produced. Boron is used throughout the series.

In the stainless steels shortages are encountered of nickel, columbium and tantalum. One solution is to switch to straight chromium steels. Keeping carbon under 0.03% and aluminum on the high side will improve the ductility of these steels.

The extreme shortage of columbium for stabilized steels has been alleviated somewhat by using a combination of columbium and tantalum.

A shortage of cobalt for high-temperature alloys requires the development of substitutes. At present this is still a problem, but new cobalt-free alloys and possibly ceramals should help mitigate this situation.

The outlook for toolsteels is none too good, for both molybdenum and tungsten are scarce at present. By increasing vanadium to values approaching 6% some stretching of present output may be accomplished.

In conclusion, Dr. Kinzel spoke about the progress made in educating design engineers to use steels "to fit the job" instead of "overdesigned" steels. Such a line of education is necessary if engineers are to lower the "factor of ignorance" (factor of safety).

Exploration of 25 Titanium Alloy Systems Continues

Reported by George H. Thurston
Metallurgist, Benicia Arsenal

Titanium, the newly developed commercial material which is attracting wide interest, was the subject of a talk before the Golden Gate Chapter A.S.M. on March 12 by C. I. Bradford, director of operations, Rem-Cru Titanium, Inc. Factors that are hastening its development, according to Mr. Bradford, are its abundance in the earth's crust, its unique combination of mechanical properties and corrosion resistance, and its favorable ratio of mechanical properties to density.

C. I. Bradford

Corrosion resistance of certain titanium alloys is superior to that of aluminum alloys and stainless steel between 300 and 1000° F. While corrosion resistance is remarkable in many mild environments, high-temperature service will probably never exceed 1300° F., Mr. Bradford said. Because of its extreme chemical activity, the metal is passive rather than noble, and is either tremendously successful or completely unsatisfactory for specific corrosive environments.

Hot and cold working characteristics are good and autogenous welding with inert-gas shielding is both convenient and successful. Certain difficulties, however, confront the users of the new metal. It is about as difficult to machine as 18-8 stainless steel, and forms an extremely hard oxide-nitride scale which wears tools quickly and makes light cuts difficult. Brazing is as yet impractical, as is welding of titanium to other metals. The metal has an extreme tendency to seize and gall.

Commercial smelting is done by the Kroll process, which consists of reducing titanium tetrachloride with molten magnesium. The most difficult step is the melting of the sponge to yield solid ingots. This is done in cold crucibles of copper or graphite under inert gas with heat applied by electric arc. The cold crucible freezes a skin of metal so that the melt is prevented from attacking the refractory and thus becoming contaminated. Present practice is batch melting, but continuous casting is expected to be a natural development.

Present work on the new metal includes exploration of the 25 potential alloy systems and some nonmetallic titanium systems. Alloys have been developed with 200,000 psi. tensiles and usable ductilities. The 7% manganese binary alloy, which has a yield point of 130,000 psi. at room temperature, shows 60,000 psi. yield at 800°F. This compares favorably with any material in general use today, and on a strength-per-unit-weight basis far exceeds any common metal.

As the uses of titanium increase and tonnage mounts, the cost will be lowered, even without major changes in production methods. We may confidently expect that the future will hold as much expansion and development as the past four years, Mr. Bradford predicted, and that titanium will continue to hold its position as "the new metal". This remarkable development of a new technology is a striking tribute to the organizations which have pioneered it and to the essential virility of American private enterprise, the speaker asserted in conclusion.

Tarasov Speaks at New Haven

Reported by Fred Storm
Chase Brass & Copper Co.

Following a plant visit to the Waterbury Farrel Foundry & Machine Co., Leo P. Tarasov of the Norton Co., discussed "Metallurgical Aids to Better Grinding" before the New Haven Chapter A.S.M. Past chairmen of the chapter were honored at this meeting, held on April 19.

Dr. Tarasov's talk has been reported in previous issues of *Metals Review.*

Inspect Typewriter Manufacture

Hartford Chapter Members Inspect One of the Assembly Operations in the Manufacture of Typewriters at the Plant of Royal Typewriter Co.

Reported by Lester F. Spencer
Landers, Frary & Clark

Some 75 members and guests of the Hartford Chapter A.S.M. visited the plant of the Royal Typewriter Co. in April. They were welcomed by F. Martin, mechanical superintendent, and A. S. Cooke, industrial relations manager. During the afternoon the visitors toured the press rooms, the automatic screw machine shops, the heat treating department, electroplating and organic finishing departments, and the assembly line. Assembly operations on the standard type, the portable and the new electric typewriter were viewed.

Following dinner Wayne Bolton, sales training manager of the New York office, spoke on the growth of the typewriter from its inception to the present-day models. He traced the development of the new electric typewriter and presented the features of the various models that the company is manufacturing today.

At the Speakers' Table Are Wayne Bolton, Sales Training Manager, Who Spoke on Typewriter Development and Manufacture; F. Martin, Maintenance Supervisor; John Mertz, Chapter Chairman; A. S. Cooke, Industrial Relations Director; and Harold Sprague, Chapter Secretary

Multi-Casting Process Offers Control Over Pouring Temperature

Reported by W. B. Moore
Technical Service Engineer
Reynolds Metals Co.

An individualistic approach to foundry problems resulted in a challenging lecture on "Recent Developments in Large 'Precision' Castings" before the April meeting of the Louisville Chapter A.S.M. The speaker, H. H. Harris, president of General Alloys Co., dealt mainly with the use of extremely accurate, highly finished castings to eliminate the costly machining of irregular curved surfaces.

Casting the heat resistant alloys offers all of the usual foundry problems, plus several that are peculiar to the complex alloys involved, and Mr. Harris refuses to accept the partial remedies offered by conventional foundry equipment and methods. He and his company have allowed a refreshing combination of ingenuity and sound engineering to reduce ordinarily uncontrollable variables in the casting process.

For example, after determining the properties of graphite and ceramic molds for a specialized application in high-temperature alloys, the Company has developed new combination mold materials known as "Grapheramic" that combine the desired refractoriness, accuracy, finish and permeability for large "precision" castings.

Slides were shown comparing these Grapheramic and graphite molds. Also illustrated were a "controlled-rate" pouring machine to overcome the inequalities of manual pouring, the new types of multi-casting machines, and controlled grain sizes with high elongation in as-cast structures resulting from controlled temperatures and pouring rates.

Conventional precision casting methods employing hot molds and "toy" melting furnaces result in castings with coarse and highly variable grain structure, and unpredictable fatigue life. The lower pouring temperatures and molten metal controls afforded by the multi-casting process produce "high integrity" castings of predictable structure and physical properties, the speaker showed.

A principal advantage of multi-casting, he continued, is that many molds may be poured and a large number of castings cast simultaneously. This eliminates the great variation in pouring temperature caused by successive pouring of a number of molds from one ladle.

"If the metal is hot enough to pour the last mold, it is far too hot to pour the first one," said Mr. Harris. Slides were projected showing bend tests on castings poured at the conventional 250° variation in temperature. A variation of about four to one was found in both bend tests and elongation on each of several types of alloys poured sequentially from the same ladle at progressively lower temperatures. The relation of structure and elongation to pouring temperatures was clearly demonstrated.

Outlines R.P.I. Welding Research

E. F. Nippes (Center), Supervisor of Welding Research at Rensselaer, Outlined the Work of His Department at the March Meeting of the Eastern New York Chapter. At left is A. B. Burr, also of Rensselaer Polytechnic Institute, program chairman; and at right is Berkeley Ellis of American Locomotive Co., vice-chairman of the chapter

Reported by A. Lesnewich
Rensselaer Polytechnic Institute

Much of the success of the welding research program at Rensselaer Polytechnic Institute can be attributed to the knowledge acquired of the time-temperature cycles involved in the arc, flash and spot welding processes. This topic was discussed by Ernest F. Nippes, supervisor of welding research at Rensselaer, at the March meeting of the Eastern New York Chapter A.S.M.

Temperatures in the arc welded material are measured with special equipment. A 0.010-in. thermocouple wire is fastened by condenser-discharge welding at the base of strategically located holes. The amplified signals are recorded with an Esterline-Angus recorder while the sample is welded. The idea, basically, is to record the fastest cooling rate in the coarsest grain structure of the weldment.

By measuring the variations in cooling rates caused by changes in plate thickness, preheat temperature, arc voltage, arc current, and travel speed it was possible to derive a mathematical expression which includes these variables and relates the cooling rates at any point in the weldment for most conditions. This information was applied to exact steels by using the Jominy end-quench test. The steels were austenitized for 1 hr. at 2100° F. to obtain a grain size equivalent to the coarse-grained region adjacent to the fusion line of the arc weld. The maximum cooling rate through the transformation region for the attainment of soft transformation products can be obtained from the Jominy data. It is then possible to design welding conditions which will provide the maximum cooling rate and so produce a weldment free of martensite.

Dr. Nippes showed that cooling rates in spot welding can be remarkably high. As an example, in spot welding $\frac{1}{16}$-in. material cooling rates may average as high as 1500° F. per sec.—enough to form martensite in 0.10% carbon steel. Since these cooling rates cannot be avoided, techniques have been developed for grain refining and tempering hardenable steel as part of the spot welding cycle.

Flash welding thermal cycles tend to establish temperature gradients which become constant during the flashing process. Therefore, to conserve material and time in production, it is desirable to know when this equilibrium gradient is established. Since the time rate of change of temperature is so rapid, electromagnetic oscillographs are used to record the temperatures in flashing. Mathematical expressions for heating rates and thermal equilibrium could be used to design flashing conditions for any alloy.

A method for heating individual Charpy samples to the exact time-temperature cycle which occurs at any point in the weldment has been developed at the Institute. Duplicating the actual cycle to within ±5° F., this technique has shown that, with the exception of the very coarse-grained section, the various structures in the region known as the heat-affected zone are superior to the base plate. A surprising inferiority of the regions heated to below 1200° F. was attributed to strain aging.

Editor's Talk Ranges Over Iron Ore Supplies, Continuous Casting and Extrusion

Reported by Thomas S. Simms
Research Information Service
John Crerar Library

Speakers' Table at Chicago Chapter Meeting Included C. T. Prendergast, Program Chairman; D. I. Brown, Feature Editor, The Iron Age, *Principal Speaker; W. E. Mahin, Chapter Chairman; H. L. Geiger of International Nickel Co.; and Eugene Beaudet, Chicago Editor,* The Iron Age

A talk entitled "Behind the Scenes of Metallurgy", presented before the Chicago Chapter A.S.M. at the Feb. 12th meeting, ranged from the current material situation in iron ore to the latest developments in hot and cold extrusion. The speaker was D. I. Brown, who is feature editor of *The Iron Age.*

The Mesabi range has been supplying about 85% of our iron ore needs, Mr. Brown stated. However, two costly wars and the present insatiable thirst for more and more steel products have made it imperative to supplement the dwindling supply of high-grade domestic ore with imported ores.

In Venezuela, U. S. Steel Corp. is developing an ore field estimated to contain 1½ to 2 billion net tons. The ore is hematite and analyzes 63% iron. Only 500 million tons, however, are proven reserves. By the spring of 1954 U. S. Steel hopes to ship 3 million tons into Mobile, Ala., and 7 million tons into Baltimore.

Another extensive ore development is in Quebec. The field is estimated to contain 1½ billion tons of hematite ore, with proven reserves of 400 million tons. The ore contains 59 to 60% iron. This area is slated to ship 10 million tons of ore to the United States by 1954.

Several important developments have been made in continuous casting, Mr. Brown continued. Among these are the Scovill and Rossi-Junghaus processes for brass, the Hazelett process for aluminum and brass, the Properzi process for aluminum and zinc, and the Babcock & Wilcox-Republic Steel Co. and Rossi processes for steel.

In the Properzi process for aluminum, the machine casts an equilateral triangular section ⅞ in. on a side. A holding furnace pours molten metal into a trough which feeds the hot metal reservoir or ladle mounted on the casting machine. The casting machine consists of two revolving drum wheels and a steel band. The band passes over the drum wheels and serves as one side of the mold cavity which is cut in the copper portion of the bottom wheel. Water is circulated inside the hollow hub section of the lower two-piece wheel. The bottom portion of the casting wheel is also immersed in a tank of water. The aluminum leaves the holding furnace at a temperature of 1220 to 1240° F. The triangular bar emerging from the casting machine passes over the head of the operator to a 15-stand continuous rolling mill. The mill converts the cast section into coiled rod. The average weight of aluminum cast per hour is 1000 lb. Only three men are needed for the entire operation.

With the present demand for steel products far outstripping the supply, more efficient methods of fabrication are being adopted and further improved. One of these is the cold extrusion process.

Advantages of cold extrusion of steel are better surface finish, tensile strengths up to 120,000 psi. without heat treatment, close tolerances, utilization of standard grades of steel, tendency to eliminate center defects, manganese content cut from 1% to ½%, and saving of steel. In the manufacture of 120-mm. shells, the conventional method requires 82 lb. of metal initially, whereas the cold extrusion method starts with a 40-lb. blank.

In 1940 experimental work on the hot extrusion process was started in France, and the first production unit was placed in operation in 1949. Alloys which cannot be easily rolled or forged are processed from ingots directly into bars, tubes, wire and complicated shapes. The process features uniform mechanical properties, low tooling cost, and low scrap—less than 1%.

Speaks at Penn State on Corrosion

At the March Meeting of Penn State Chapter Are William W. Wentz, Chapter Reporter; Wm. Fricke, Vice-Chairman; C. H. Sample of International Nickel Co., the Speaker; and L. E. Colteryahn, Technical Chairman. Mr. Sample's talk on "Corrosion and the Protective Value of Metallic Coatings" was reported in the February issue of Metals Review, page 9

Experimental Instrument For Surface Roughness Measurement Described

Reported by Arthur C. Willis
School of Engineering
Southern Methodist University

Surface roughness is a dimension, not a condition. Thus was keynoted the address by A. L. Barnett, president of Storm-Vulcan, Inc., Dallas, before the North Texas Chapter A.S.M. on Feb. 21.

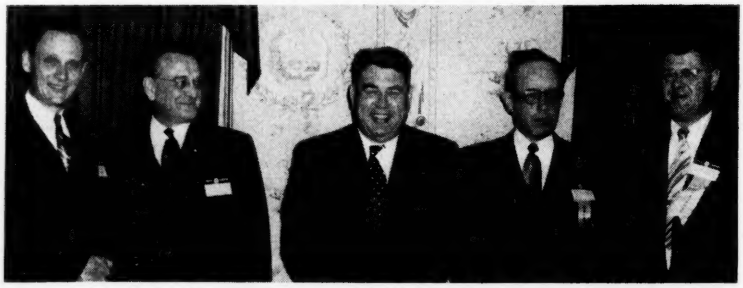
The entire subject of surface roughness, or surface finish, is controversial, progress in this field having been retarded by lack of measuring devices. Developments in measurement of surface roughness have come largely in the past 25 years. The first use of a tracer point in 1929, by Schmalz, in Germany, was a great step forward. Then followed the profile-graph, the profilometer, and the surface analyzer.

In a search for easier methods of measurement, which would not be confined to the laboratory, Storm-Vulcan has developed an electronic instrument which operates on the average height of ridges on the surface, not the depth of scratches.

In presenting this information, Mr. Barnett emphasized that this instrument is definitely experimental. Storm-Vulcan's primary product is machinery for the refinishing of crankshafts and similar parts.

Various applications where surface finish is increasingly important were cited, especially in ordnance and automotive fields.

Grossmann Visits Texas



At a Recent Texas Chapter Meeting Are M. W. Phair of Tennessee Coal, Iron and R. R. Co., Secretary-Treasurer; G. J. Stewart, Also of T. C. I. & RR.; Charles Lewis of Cook Heat Treating Co.; M. A. Grossmann, Director of Research, U. S. Steel Co., Guest Speaker; and Harold Schmid of General Metals Corp., Chapter Chairman. (Photograph by Leland V. Dolan)

Allis-Chalmers Cotton Picker Explained

During a Tour of the Allis-Chalmers Mfg. Co.'s Plant at Gadsden, Ala., Harold M. Schudt, Plant Manager (Right), Points out the Features of a New Cotton Picking Machine to Birmingham Chapter Members Ray Dyke, Metallurgist, American Cast Iron Pipe Co.; M. D. Neptune, Plant Metallurgist, National Cast Iron Pipe Div. of James B. Clow & Sons; and J. M. Edge, Metallurgist, Tennessee Coal, Iron & RR Co. (Reported by E. A. Brandler)

Inland Steel Endows Scholarship

Inland Steel Co. has established at Michigan College of Mining and Technology a four-year scholarship in any branch of engineering that finds application in the mineral industry. The first scholarship award will become effective with the 1951-52 academic year, and additional awards will be made each alternate year thereafter. The scholarship provides an annual stipend of $500. Selection of the scholar is to be made entirely by the College.

New Films

The Instrument Society of America has completed a 55-min. recording of "Principles of Automatic Control" in 16-mm. film in full color and sound. Produced as one of the Society's educational projects, this movie can be shown by engineering groups and schools. A leaflet giving details on the film can be obtained by writing the Instrument Society of America, 921 Ridge Ave., Pittsburgh 22.

Sound Film Catalog

Seventy-two sound films that cover general interest subjects, product information, and training and instruction courses are listed in a new 1951 sound film catalog available from Westinghouse. In addition to descriptive text for each film, the booklet contains instructions for operation and how-to-order information.

For a copy of Catalog B-4761, write Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa.

Cast Iron Statistics Compared to Steel Show Industry's Size

Reported by Edw. M. Mielnik
Asst. Professor of Mech. Eng. State University of Iowa

A talk on the metallurgy of cast iron, covering the production, properties, and uses of both gray and malleable iron, featured the January meeting of the Cedar Rapids Chapter A.S.M. F. T. McGuire, manager of materials engineering of Deere & Co., was the speaker. At the conclusion of his talk, he also commented on the production and properties of nodular cast iron.

Dr. McGuire emphasized the tremendous size of the iron foundry industry. Approximately a fourth as much iron is produced annually in the form of finished iron castings as the production of finished steel fabrications, he said.

Dr. McGuire then told how white iron can be converted to malleable iron with resulting changes in structure and properties. During his entire talk, he stressed the important role that the shape, size, and distribution of graphite plays in determining the mechanical properties.

The reason that gray iron is considered to be insensitive to notch impact, he stated, is because it already has so many notches within itself as a result of the graphite flakes it contains, that a few more notches on the surface don't make too much difference. The properties of gray iron vary throughout a heavy section because of the slower rate of cooling within the section; for this reason, the chemical analysis of gray iron must conform to the section size of the castings being produced.

The speaker concluded his talk by discussing briefly the history, structure, production and properties of nodular cast iron, and the part it is expected to play in the casting industry of the future. He inferred that it would not have an appreciable effect on the industry for some time to come, but that there is a place for it in the family of materials available to the engineer.

Prior to the technical talk, past chairmen of the chapter were introduced and were complimented for the excellent job they did in guiding the chapter in the past. Each chairman gave a short talk appropriate to the occasion as he was introduced. Past chairmen present were: Henry Hauseman of the La Plant Choate Co. (1945-46), Edward C. Mittvalsky of Iowa-Illinois Gas & Electric Co. (1947-48), Irwin L. Tucker of Tucker Mfg. Co. (1947-48), and Merle C. Kendall of the Metal Crafters Co. (1949-50). Richard May (1946-47) was absent as he is now living in Boston.

25-Year Members Honored

L. W. Morrell (Left), Former Secretary-Treasurer of the St. Louis Chapter A.S.M., Presented 25-Year Membership Certificates to A. B. Arnold, Representative on the Sustaining Membership of Western Cartridge Co.; C. P. Bascom, Vice-President of Fayette R. Plumb Co.; and Walter C. Joern, Division Manager of Allegheny Ludlum Steel Corp. Certificates were also sent to P. E. Chapman, president of P. E. Chapman Electric Co.; and Max A. Herzog, chief metallurgist for the St. Louis San Francisco Railway. (Reported by G. A. Fisher, Jr.)

Annealing Involves Two Unidirectional Processes Peter Payson Explains

Reported by Knox A. Powell
Research Engineer Minneapolis-Moline Co.

Annealing of steel, according to Peter Payson, assistant director of research for the Crucible Steel Co. of America, involves two unidirectional processes: the formation of an austenitic solution of carbon as the material is heated above the upper critical temperature, and the transformation of austenite as the material is cooled. The effect of alloying, said the speaker, is mainly to change the temperatures at which the formation and transformation of austenite takes place. Mr. Payson addressed the Northwest Chapter A.S.M. recently at one of its regular monthly dinner meetings.

The hardness and allied characteristics of the transformation products, Mr. Payson continued, depend chiefly upon the temperatures at which transformation takes place, and of course upon the completeness of transformation which, in turn, depends upon the time at temperature. The transformation process is delineated by the time-temperature-transformation diagram for the material. Thus, a given hardness may be the result of continuing transformation at a fixed or over a varying temperature range, or of incomplete transformation due to abbreviated time in the transformation range, or of both.

The characteristics of the transformation products of annealing are also affected by the temperature of the austenite formation preceding transformation cooling. Austenite formed just above the upper critical tends to transform to a spheroidized carbide structure, while austenite formed at higher temperatures tends to transform to a lamellar structure, coarser as the formation temperature is higher. Spheroidal structure is softer than the lamellar, and coarser lamellar structure is more friable than finer structure.

A brisk question-and-answer period followed which emphasized the relation of time and temperature to annealing characteristics, and the relation of austenitizing temperature to machinability.

Steelmaking Talk Given

Reported by John Bradbury
Algoma Steel Corp., Ltd.

How metallurgical problems are being overcome at Steel Co. of Canada was described by R. D. Hindson, metallurgist for the Hamilton Works of Stelco, at the March meeting of the Northern Ontario Chapter in Sault Ste. Marie. Of particular interest was Mr. Hindson's illustrated discussion of the manganese variation between the first and last ingot of a basic open-hearth heat.

Nodular Iron Becoming Established

Reported by Malcolm G. Simons
Pressed Metals of America, Inc.

"Nodular iron will definitely take its place along with cast steel, gray iron and malleable iron as a new member of the ferrous engineering materials." This opinion, stated by Max Kuniansky, vice-president and general manager of the Lynchburg Foundry Co. before the March 12th meeting of the Detroit Chapter A.S.M., was based on work done by the speaker's own company, as well as by many others experimenting with this new material.

While considerable amounts of this metal have been produced, there are still few applications where its use is economically practical, he pointed out. The production of nodular cast iron requires very close control in the melting, treating and pouring stages. Castings poured from this iron also require different gating and risering than for regular cast iron.

The Lynchburg Foundry has successfully produced castings of up to 15 tons from this ductile metal. They also make large pipe sections which compare very well with steel pipe. They use the nickel-magnesium alloy treatment on iron melted in the basic-lined cupola.

M. Kuniansky at Detroit

The meeting honored the sustaining members of the chapter, and representatives of these companies were seated together at a special table for dinner, and later introduced individually to the entire group. "The Prosecutor's Office and the Kefauver Committee" was the title of the coffee talk by Ralph Garber, chief assistant prosecutor of Wayne County.

Quality Control Important In All Operations of Melting and Processing

Reported by Roy C. Raymond
Singer Manufacturing Co.

A concise and factual talk on the controls which must necessarily be exercised in the manufacture of high-grade steels was delivered before the New Haven Chapter A.S.M. on March 15 by Edward E. Hall, chief metallurgist, Cyclops Division, Universal-Cyclops Steel Corp.

Mr. Hall emphasized that quality control is important during all operations of the melting and processing of a heat of high-grade steel. All materials going into the melting furnace must be as free from contaminants as possible, since minute percentages of such elements as lead, tin, or bismuth, prove detrimental during later processing. Rapid spectrographic analysis during melting is a valuable aid in the control of the final chemistry of heats.

Melting, refining, tapping, tapping temperatures, ingot size, mold design and rate of cooling all affect the inherent characteristics and the quality of the steel. Center soundness and carbide segregation are influenced by these factors, as well as by the amount and method of reduction used in processing steel to finished sizes.

Decarburization continues to be a problem. Atmosphere annealing furnaces are being used more generally but they are not foolproof and considerable experimental work is necessary to set up proper atmospheres and cycles.

Armco Is Host to Dayton A.S.M. Members and Wives

Reported by James W. Poynter
Metallurgist
Wright Patterson Air Force Base

Members of the Dayton Chapter A.S.M. and their wives were treated to a fried chicken dinner by Armco Steel Corp. as the first event in a tour of Armco's East Works in Middletown, Ohio, on March 14.

At the conclusion of the dinner, Dave Tranter, manager of the Middletown Division, gave a brief talk pointing out the long-range planning and development necessary to keep a steel mill in successful operation. The present sources of iron ore and possible future sources were also touched upon.

When the company began operations 50 years ago, Mr. Tranter said, emphasis was placed on the importance of people and the dignity of the individual instead of on the machines. This philosophy of the mutual interest of management, and the men and women employed in the business was an innovation.

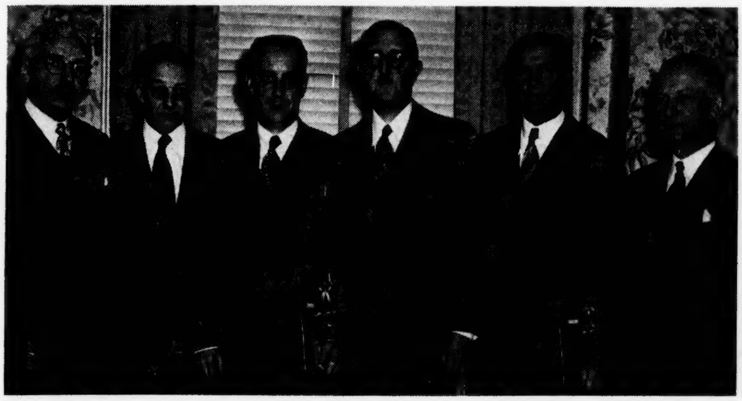
Other developments which Armco pioneered were in plant integration, the manufacture of specialty products, the production of Armco ingot iron, the continuous mill and the melting and rolling of silicon steels.

After Mr. Tranter's talk a trip through the plant was made. The nontechnical visitors were greatly impressed by the blooming mill and the continuous hot strip mill, while the more technically minded found the continuous annealing and pickling of strip and the Zincgrip galvanizing processes of major interest.

Reviews Aluminum Alloys

Harold Y. Hunsicker (Second From Left), Assistant Chief of the Cleveland Research Division, Aluminum Co. of America, Presented a Thorough-Going Review of the Properties and Uses of Aluminum Casting and Forging Alloys Before the North Texas Chapter A.S.M. on March 13. In the photo are Arthur C. Willis, chapter vice-chairman; Mr. Hunsicker, John M. Thompson, Jr., chairman; and Harry Slayback, of Alcoa's Dallas District Office.
(Reported by Arthur C. Willis, Southern Methodist University)

Boston Quarter-Century Club Expanded



A. S. M. President W. E. Jominy Presents 25-Year Certificates to Four Members of the Boston Chapter A.S.M. on President's Night. From left are Chairman Peter Kosting, Recipients George S. Downing and Richard F. Bailey, President Jominy, and C. W. Babcock and John M. Lessells. (Photograph by H. L. Phillips; Reported by Andreas Hartel, III)

Shows How Statistical Control Can Be Used As Management Tool

Reported by A. F. Schroeder

Chief Metallurgist, Cardwell Mfg. Co., Inc.

The benefits of quality control can be reaped only where there is close integration among the engineering, manufacturing and quality control departments. How this integration can be effected and how statistical quality control can be used as a management tool was shown by Robert E. Layton, quality control manager of the O. A. Sutton Corp., in a talk before the Wichita Chapter A.S.M. on March 20.

In addition to the usual applications of quality control technique, statistical methods may be used to set equitable piece rate standards and standards for spoilage control, Mr. Layton explained. Moreover, yields from raw materials can be closely controlled and understood by the use of frequency distribution charts.

The speaker described the use of several kinds of control charts, and cited actual shop experiences. Proper interpretation of the control charts is important in prescribing the kind of action to be taken to correct an undesirable condition. Also, too often control charts cease to be valuable because the shop foreman is not properly trained in control chart "appreciation".

Mr. Layton concluded by predicting that within a few years—and as a result of the application of statistical quality control techniques—our present-day method of assigning tolerances to individual pieces will be outmoded and tolerances will be assigned on a "group" basis.

The question-and-answer period brought out that the application of quality control techniques to very low production items is possible, but generally is economically unsound. The most effective results are obtained where production is high.

Compliments

To Mars G. Fontana, chairman of the department of metallurgy at Ohio State University, on his election as vice-president of the National Association of Corrosion Engineers.

♦ ♦ ♦

To Harry L. Edgcomb, Jr., of Edgcomb Steel Corp., on his election as president of the newly organized National Association of Aluminum Distributors.

♦ ♦ ♦

To George L. Durfee, A.S.M. junior member at Michigan College of Mining and Technology, on his selection as one of eight engineering students in the country to receive a Tau Beta Pi graduate fellowship for 1951-52. He will begin work toward a D.Sc. degree in metallurgical engineering at Massachusetts Institute of Technology in the fall.

♦ ♦ ♦

To Paul Schwarzkopf, president, American Electro Metal Corp., on the issuance of a special "Paul Schwartzkopf Anniversary Issue" of *Powder Metallurgy Bulletin* in Commemoration of his 65th birthday.

World Metallurgical Congress
National Metal Congress
National Metal Exposition
Detroit—Oct. 15 to 19, 1951

Special Testers Simulate Service Conditions for Automotive Steels & Parts

Reported by James H. Brown, Jr.

Ritter Co., Inc.

Although standard laboratory tests are a help in selecting steels for automotive use, the only reliable method of steel selection for a given job is by testing under actual operating conditions, according to Alfred L. Boegehold, head of the metallurgical department, Research Laboratories Division of General Motors Corp. Mr. Boegehold, who is probably more familiar to "ASMers" as their national president for 1947, spoke on the "Selection and Treatment of Metals for Automotive Applications" at the annual Sustaining Members' Night of Rochester chapter A.S.M. in March.

For service tests under operating conditions, the automotive industry has developed a large number of specialized testers. Mr. Boegehold illustrated several of these machines, along with charts, as slides during the course of his lecture.

In the same vein, Mr. Boegehold explained that for use at maximum efficiency, steels of equal hardenability will not perform equally. Maximum efficiency he defined as the use of steel containing the lowest amounts of carbon and other alloying elements to give lowest cost and best machinability compatible with adequate service performance. This variation in performance of steels of equal hardenability is attributed to variations in stress patterns after heat treatment. Therefore, like the standard laboratory tests, hardenability bands are found to be an unsatisfactory tool for final steel selection in the automotive industry. Hardenability is useful as a guide for selecting steels to be tested as components.

Mr. Boegehold gave his audience a preview of work being done by the Society of Automotive Engineers in compiling charts of steels with roughly equivalent performance characteristics. These charts will follow commercial heat treatment processes as closely as possible. When completed, they will give the design engineer a selection of steels for any application, thus freeing the metallurgist for other duties.

Plan Foundry Technical Center

American Foundrymen's Society has announced a program to establish a technical center for producers of cast metals. Expenses will be borne by a fund of $100,000 raised by voluntary subscription from the Society's members. The center is to be established during the next two years in one of the principal midwestern cities with a substantial foundry industry.

Uses of Refractory Metals Correlated With Their Particular Properties

Reported by James H. Brown
Ritter Co., Inc.

Speaking on "Commercial Applications of the Important Rarer Metals" at the April 9th meeting of the Rochester Chapter A.S.M., Leonard Yntema, director of research, Fansteel Metallurgical Corp., confined his attention to the family of high-melting, low-vapor pressure metals often referred to as the "refractory metals". Principal members of the family are tungsten, molybdenum, tantalum and columbium.

Ores of the refractory metals are relatively plentiful, Dr. Yntema stated. Tungsten and molybdenum are obtained by reducing the oxides or acid with hydrogen. The oxides of tantalum and columbium, however, cannot be reduced by hydrogen, and the metal is won by electrolysis or by the sodium reduction of a potassium double fluoride. In all of the processes, a metal powder is formed.

Because of the high melting points of these metals and their tendency to react with atmospheres at elevated temperatures, melting and casting are impossible. Instead the powder is pressed into a bar and sintered with electric current. The size of the bars is dictated by the size of the press and the amount of current available for sintering. The refractory metals in the bar form can be subjected to almost any of the forming operations, with, of course, the exception of casting.

Uses of tungsten, molybdenum, tantalum and columbium are correlated with their particular properties. Tungsten, for instance, has a volatile oxide. When used as contact material, any oxide formed by arcing is volatilized by the arc and a clean surface maintained. With its high melting point and low vapor pressure, tungsten can withstand temperatures of 2500°C. in incandescent light bulbs without darkening the bulb. It is also used in vacuum tubes where high temperatures are required for high emissivity.

Molybdenum, because of its high current-carrying capacity, finds wide application as heating elements in resistance furnaces and in electronic equipment. When protected by a siliconized coating, this metal makes an excellent high-temperature thermocouple well.

Tantalum plays an important part in the manufacture of chemicals, because of its inertness to acids (other than hydrofluoric and fuming sulphuric), and its excellence as a heat transfer medium. The gas-absorbing property of tantalum makes it an invaluable constituent in transmitter tubes. This absorbing or "getter" action means that, at the normal operating temperature of around 2800° F., tantalum will absorb gases given off and diffusing through glass, and thus will successfully maintain the required high vacuum inside the tube. Dr. Yntema also pointed out that tantalum is extensively employed in surgery because it does not interfere with growth of living cells.

Columbium, said Dr. Yntema in conclusion, is similar to tantalum but inferior to it in most applications.

Bridgman Presents Sauveur Lecture

P. W. Bridgman (Center), Noted Scientist and Harvard Professor, Presented the 18th Annual Sauveur Lecture Before the Philadelphia Chapter. At left is Joseph Gray Jackson, chapter chairman; and at right is C. C. Balke, program chairman. Dr. Bridgman's subject was "The Effects of High Stresses on Mechanical Properties of Metals"

Reported by George L. Schiel
Metlab Co.

Percy Williams Bridgman, professor at Harvard University, 1946 Nobel Prize winner and recipient of many honorary degrees and awards both here and abroad, presented the 18th annual Sauveur Lecture at Philadelphia on March 30. His lecture was entitled "The Effects of High Stresses on the Mechanical Properties of Metals".

Dr. Bridgman prefaced his address with a few brief reminiscences of his early work with Dr. Sauveur at Harvard. He showed some actual photomicrographs made by Dr. Sauveur in conjunction with early studies of the behavior of metals under high stresses.

When the conventional tensile test is performed at 30,000 atmospheres, Dr. Bridgman reported very high tensile strength and ductility values. Under these extremely high hydrostatic pressures ductility particularly seems almost unlimited. Reduction of area figures for mild steel run as high as 99.7%, and for cast iron as high as 84%. As the pressures are increased the character of the fracture changes from the usual ductile cupcone type to a single 45° shear-angle type. These interesting effects at high pressures, Dr. Bridgman stated, are caused by the actual welding of the slip planes and microcracks by the high pressures.

At the conclusion of the address Dr. Bridgman was presented with the Sauveur Certificate by Chairman Jackson.

At dinner ten "old timers" reminisced of the early activities of the chapter.

Jominy Spends Busy Day With York Chapter

Reported by A. Floyd Whalen
Metallurgist and Chemist

Selecting Wednesday, May 9, out of a busy week of chapter visits, A.S.M. National President Walter E. Jominy met with the York Executive Committee during the noon period and discussed both chapter and national A.S.M. problems. At the evening session before a large attendance he presented the subject for which metallurgists throughout the land will forever call him blessed: "Why steel hardens and how to produce and duplicate the same results in steel products".

Mr. Jominy gave of himself bountifully to the chapter from the time he arrived in town at noon until the evening meeting adjourned at 10:00 p.m. It was only part of a busy week that included visits to Washington, Baltimore, Providence and Boston.

Prior to his lecture Mr. Jominy awarded past chairmen's certificates to A. J. Kleiner, A. R. Kunkle, C. M. Strickler and Glenn Frank, and 25-year membership awards to Norman J. Gebert, Amos D. McGarvey, John D. Dyson and J. R. Konold.

The Hamilton Watch Co. also showed a film entitled "Metallurgy in Miniature".

Copper an Example Of Old Material With New Possibilities

Reported by J. P. Simpson
Chief Chemist
Canadian Car & Foundry Co., Ltd.

While copper is an old material dating back to antiquity, new uses and new developments can always be found by those who seek them, said John R. Freeman, Jr. of American Brass Co., in addressing the Montreal Chapter A.S.M. at the March meeting.

Copper's valuable natural qualities are its resistance to corrosion, high electrical conductivity, and ductility. As an example of its lasting qualities, Mr. Freeman told of a roof on a church in Philadelphia that has been in service for 213 years. It was recently examined and measurements were taken to determine the average corrosion rate. The tests proved that the roof was good for many years to come. Incidentally, Mr. Freeman pointed out to those interested in corrosion test methods, the tests conducted in the laboratory and under various atmospheric conditions have correlated quite closely with the corrosion rate found to have occurred on the copper roof of this old church.

Copper alloys with many other elements. Nickel, for example, can be alloyed with copper in all proportions across the equilibrium diagram from pure copper to pure nickel. The most important of these is probably the alloy containing 70% Cu and 30% Ni—the standard alloy for ship condensers in both the American and British navies.

Studies on a 90-10 Cu-Ni alloy with about 0.8% iron have shown that its resistance to corrosion in sea water is equivalent to the standard 70-30 alloy. The possibilities thus offered for conservation of nickel in the present emergency should not be overlooked, Mr. Freeman pointed out.

The speaker stressed the uses of alloys that can be heat treated, such as beryllium copper, chromium copper and commercial bronze. In research work on an old and enduring material such as copper, he concluded, the principal new developments are more along the lines of control, perfection of product and development of more efficient production practices. Competition from newer materials has been progressive but stimulating.

Mr. Freeman was introduced by Chairman Karl C. Baker and thanked by Prof. J. V. McEwan. The discussion period was under the chairmanship of C. T. Meredith of Anaconda American Brass, Ltd. His firm also provided a film on "Copper—Mining, Smelting and Refining".

Speaks on Grinding Metallurgy

Reported by D. J. Girardi
Metallurgical Department
Timken Steel and Tube Division

The metallurgical and physical aspects of grinding were discussed at the April 9th meeting of the Canton-Massillon Chapter A.S.M. The talk, presented by L. P. Tarasov, metallurgical engineer for the Norton Co., has been reported in detail in previous issues.

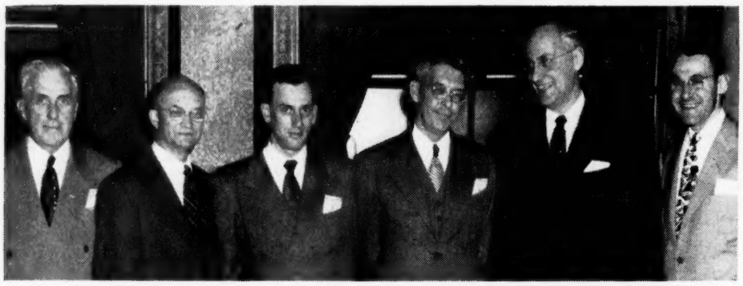
Special guests at this meeting were 12 members with 25 or more years in A.S.M. Silver certificates were awarded to M. H. Schmid, G. A. Stumpf, R. W. Thompson, J. D. Armour, E. K. Mull, F. J. Griffiths, W. G. Bischoff, J. E. Fick, C. L. Clark, D. H. Ruhnke, J. Vignos, and W. M. Wikoff.

IMPORTANT MEETINGS *for July*

July 23-27—American Association for the Advancement of Science. Gordon Research Conference on Corrosion, New London, N. H. (Dr. W. George Parks, Conference Director, Rhode Island State University, Providence, R. I.)

July 30-Aug. 2—American Electroplater's Society, Annual Convention, Statler Hotel, Buffalo, N. Y. (A Kenneth Graham, Executive Secretary, A.E.S., P. O. Box 168, Jenkintown, Pa.)

Super High Speed Steels Developed



At Chicago Chapter's Head Table on "Toolsteel Night" Were S. C. Parker of Peoples Gas Light & Coke Co.; C. S. Barrett, of Institute for the Study of Metals, University of Chicago; F. Kisslinger, Illinois Institute of Technology; C. T. Prendergast, Western Electric Co., Chapter Vice-Chairman; W. R. Frazer of Union Twist Drill Co., the Speaker; and J. A. Kubik of Stewart-Warner Corp., Technical Chairman

Reported by Thomas S. Simms
Research Information Service
John Crerar Library

"Toolsteel Night" was celebrated by the Chicago Chapter A.S.M. on March 12, with an address by W. R. Frazer, chief metallurgist of the Union Twist Drill Co.

Dr. Frazer introduced his talk on "Mid-Century Trends in High Speed Steel" by discussing N.P.A. order M-30 which became effective March 1. This order stipulates that 80% of the total deliveries of toolsteels must be of the Class A types containing 6.75% or less of tungsten, and only 20% may be of the Class B types containing 12% or more of tungsten.

The properties required of satisfactory cutting materials are, briefly, hot hardness to resist wear and abrasion at the cutting temperature, and toughness to resist chipping of the cutting edge. The former is affected by the hardening temperature and the chemistry of the material and the latter by the hardening temperature, grain size, temper, and the size of the carbides.

Microhardness surveys of several high speed steels have revealed a variation in the hardness of some of the carbides, Dr. Frazer explained. By means of X-ray diffraction studies and suitable etchants the constituents of high speed steel have been isolated and identified. These are Fe_4W_2C or Fe_4Mo_2C (for convenience identified as M_6C); $Cr_{23}C_6$ ($M_{23}C_6$); Fe_3Mo_2 or Fe_3W_2 (M_3R_2); and VC (MC).

During the hardening operation the $M_{23}C_6$ constituent readily dissolves, thus furnishing carbon for forming austenite, the M_3R_2 is completely soluble, the M_6C partially soluble, and the MC (or vanadium carbide) is practically insoluble. The M_6C carbide has a hardness of Rockwell C-74, and the MC carbide C-84, as determined by microhardness tests.

The newer toolsteels with lower tungsten and higher vanadium contents than the 18-4-1 or the 18-4-2 types are referred to as the super high speed steels since they possess a greater percentage of MC, the hardest carbide constituent present in high speed steel.

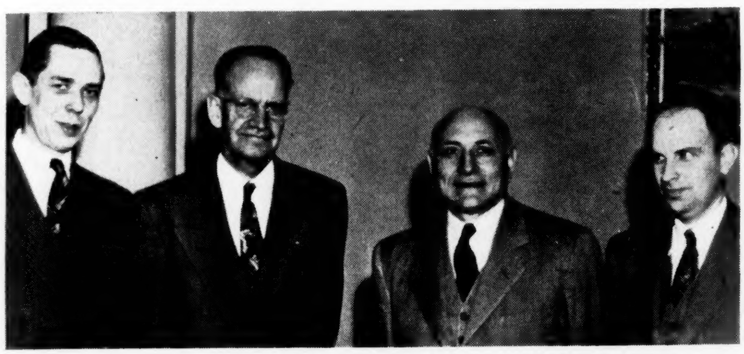
These super high speed steels have created new grinding problems. The harder tools require softer, freer cutting wheels and better coolants. The grinding wheel manufacturers have done an excellent job of studying these problems and will recommend the best wheels to use. The increased production which the super high speed steel will give, particularly on heat treated steel parts and cast iron, justifies use of the recommended grinding wheels, Dr. Frazer believes.

N. Y. U. Starts Ti Research

Watertown Arsenal has awarded a contract to the research division, New York University College of Engineering, to cover studies on titanium alloyed with the metalloids—carbon, nitrogen, oxygen and boron.

Harold K. Work, director of the research division, in announcing the contract, said the work will be under the direction of John P. Nielsen, associate professor of metal science. The project is aimed at obtaining phase diagrams to facilitate the development of titanium alloys for the engineering materials field.

Cites Sheet Steel Production Increase



Principals at the April Meeting of the Mahoning Valley Chapter Included J. R. Moore of Electric Furnace Co., Technical Chairman; H. H. Smith of Youngstown Sheet and Tube Co.; Samuel Epstein of Bethlehem Steel Co., the Speaker; and John W. Frame, Also of Bethlehem (Photograph by Henry Holberson, Chapter Vice-Chairman)

Reported by J. G. Cutton
Metallurgist,
United States Steel Co.

"The Metallurgical Aspects of Deep Drawing Steel" was the subject of the Mahoning Valley Chapter's last technical meeting of the year on April 10. The speaker, Samuel Epstein, research engineer for Bethlehem Steel Co., presented the lecture, most of which has been reported previously in *Metals Review*.

Mr. Epstein prefaced his technical talk with facts on the increased production of sheet steel over recent years. Sheet, he said, now accounts for nearly 40% of the entire steel output as compared to under 25% 20 years ago. This enormous increase in tonnage can be attributed largely to the continuous strip mills which have replaced the hand sheet mills.

Today a customer may purchase 20-gage sheet material at a lower cost than the same material 25 and 30 years ago, the speaker pointed out —this, in spite of our inflated economy. Furthermore, the quality of today's sheet product is superior.

An interesting point of the technical lecture was the use of the torque magnetometer in correlating preferred grain orientation and drawability. This instrument is primarily still a research tool and future development is anticipated.

Mr. Epstein was assisted by John W. Frame of Bethlehem Steel Co. and was introduced to the chapter by J. R. Moore of Electric Furnace Co., of Salem, Ohio.

6th METALLOGRAPHIC EXHIBIT

Rules are simple and few; there are no restrictions as to size or method of mounting, except for entries from overseas. As in the five previous exhibits, the entries will be displayed to good advantage.

CLASSIFICATION OF MICROS

- Cast irons and cast steels
- Toolsteels (except carbides)
- Irons and alloy steels (excluding stainless) in wrought condition
- Stainless and heat resisting steels and alloys
- Light metals and alloys
- Heavy nonferrous metals and alloys
- Powder metals (and carbides) and compacts
- Weld structures (including brazed and similar joints)
- Series of micros showing transitions or changes during processing
- Surface phenomena
- Macrographs of metallurgical objects (2 to 10 diam.)
- Results by non-optical or unconventional techniques

RULES FOR ENTRANTS

Work which has appeared in previous metallographic exhibits held by the American Society for Metals is unacceptable. Photographic prints shall be mounted on stiff cardboard, each on a separate mount, each carrying a label giving:

Name of metallographer
Classification of entry
Material, etchant, magnification
Any special information as desired

Transparencies or other items to be viewed by transmitted light must be mounted on light-tight boxes wired for plugging into lighting circuit, and built so they can be fixed to the wall.

Exhibits must be delivered between Sept. 20 and Oct. 10, 1951, either by prepaid express, registered parcel post, or first-class letter mail.

Address: Metallographic Exhibit
National Metal Congress and Exposition
State Fair Grounds
Woodward & State Fair Ave., Detroit, Mich.

AWARDS AND OTHER INFORMATION

A committee of judges will be appointed by the Metal Congress management which will award a First Prize (a medal and blue ribbon) to the best in each classification. Honorable Mentions will also be awarded (with appropriate medals) to other photographs which, in the opinion of the judges, closely approach the winner in excellence.

A Grand Prize, in the form of an engrossed certificate, and a money award of $100 will be awarded the exhibitor whose work is adjudged best in the show, and his exhibit shall become the property of the American Society for Metals for preservation and display in the Society's headquarters.

All other exhibits will be returned to owners by prepaid express or registered parcel post during the week of Oct. 22, 1951.

Entrants living outside the U.S.A. will do well to send their micrographs by first-class letter mail endorsed "May be opened for customs inspection before delivery to addressee". To meet regulations of the international mails, size of mount must be no larger than 14 x 18 in.

WORLD METALLURGICAL CONGRESS
33rd NATIONAL METAL CONGRESS AND EXPOSITION

DETROIT, MICH. **OCTOBER 15 TO 19, 1951**

A. S. M. Review of Current Metal Literature

An Annotated Survey of Engineering, Scientific and Industrial Journals and Books Here and Abroad, Received During the Past Month

Prepared in the Library of Battelle Memorial Institute, Columbus, Ohio
W. W. Howell, Technical Abstractor
Assisted by Mary Lee Mote, N. W. Baklanoff, Fred Rothfuss, and Leila M. Virtue

A

GENERAL METALLURGICAL

148-A. D-Enameling—A Method of Conserving Steel and Reducing Scrap Loss. Arthur M. Lander. *Better Enameling,* v. 22, Apr. 1951, p. 6-9.
Method of and reason for removing enamel from scrap steel.
(A8, L12, ST)

149-A. Magnesium and Magnesia. *Mining Journal,* v. 236, Apr. 6, 1951, p. 316-318.
History and present production position in the United Kingdom.
(A4, Mg)

150-A. The Aluminum Industry Investigations. *Modern Metals,* v. 7, Feb. 1951, p. 19-21, 23, 25, 27-29; Mar. 1951, p. 20-21, 23-24, 26, 29-30, 32, 36-38, 40, 42, 45-48; Apr. 1951, p. 24-25, 27-29, 31-32, 37-38, 41-44, 46.
Summarizes proceedings of House Monopoly Committee hearings covering shortages, expansion, imports, and sales. (A4, Al)

151-A. Operations Reflect Return of Crisis Economy. *Steel,* v. 128, Apr. 30, 1951, unpaged insert.
26th annual financial analysis of the steel industry, representing 95% of steelmaking capacity, presents financial data for 30 leading steel companies in the U. S. (A4, ST)

152-A. German Methods for the Recovery of Zinc From Galvanized Iron and Steel Scrap. E. R. Thews and M. Stromeyer. *Electroplating and Metal Finishing,* v. 4, Apr. 1951, p. 133-134. (Translated from *Metalloberfläche.*)
Previously abstracted from original under similar title. See item 313-A, 1950. (A8, Fe, Zn)

153-A. Stelco Expands. *Canadian Metals,* v. 14, Apr. 1951, p. 12-14.
Expansion of Steel Co. of Canada, Ltd. (A4, ST)

154-A. Blast Furnace Slag Building Materials. T. W. Parker. *Transactions of the Institution of Engineers & Shipbuilders in Scotland,* v. 94, pt. 4, 1950-51, p. 192-225; disc. p. 225-233.
Compares utilization of slag in the U. S., Scotland, and Germany. An overall picture of a number of investigations carried out at the Building Research Station since 1934, on granulated slag for cements, foamed slag for light-weight concrete, and slag as a concrete aggregate. 14 ref.
(A8)

155-A. The Mechanical Engineering Research Laboratory, East Kilbride, Scotland. G. A. Hankins. *Transactions of the Institution of Engineers & Shipbuilders in Scotland,* v. 94, pt. 4, 1950-51, p. 234-260; disc., pt. 5, p. 261-265.
Main purposes of the new laboratory will be basic and applied research in materials, mechanics of solids, mechanics of fluids, lubrication, mechanisms and metrology, formation and shaping of materials, and heat transfer. The way in which the work will be developed, and researches at present in progress in temporary accommodations. (A9)

156-A. More Aluminum for Defense: How Natural Gas Makes More Sheets. Arthur Q. Smith. *Gas Age,* v. 107, Apr. 26, 1951, p. 67-70, 100-102.
Procedures and equipment of Alcoa's new plant at Davenport, Iowa. Emphasis is on gas-fired equipment.
(A5, F23, Al)

157-A. Recent Furnace Installations by Alcoa for Production and Fabrication of Aluminum. Part I. Aluminum Ore Reduction at Point Comfort, Texas. *Industrial Heating,* v. 18, Apr. 1951, p. 610, 612, 614, 616, 618, 626.
(A5, B14, Al)

158-A. U. S. Foreign Trade in Iron and Steel. J. Joseph W. Palmer. *Foreign Commerce Weekly,* v. 43, May 14, 1951, p. 3-5.
Statistical comparison of 1949 and 1950, also some data for Jan. and Feb. 1951. (A4, Fe, ST)

The coding symbols at the end of the abstracts refer to the ASM-SLA Metallurgical Literature Classification. For details write to the American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.

159-A. Metal Recovery by Cation Exchange. A. B. Mindler, M. E. Gilwood, and G. H. Saunders. *Industrial and Engineering Chemistry,* v. 43, May 1951, p. 1079-1081.
Two unique processes for recovery of Sn and Zn from solutions. This work was undertaken to contribute to the solution of waste-disposal problems, conservation of strategic metals, water, and heat values. Results indicate that it is possible to employ ion exchange for recovery of tin from electroplating operations using alkaline baths. Also some preliminary data on removing and recovering Zn from relatively concentrated H_2SO_4 solutions.
(A8, Sn, Zn)

160-A. Copper—The Problem and Prospects. *Westinghouse Engineer,* v. 11, May 1951, p. 74-80.
An illustrated economic survey and forecast. (A4, Cu)

161-A. Library Use of New Indexing System. David L. Edelman. *Metal Progress,* v. 59, Apr. 1951, p. 526-528.
Experiences of past year, in the Division of Metallurgical Research, Kaiser Aluminum & Chemical Corp., with use of the ASM-SLA Metallurgical Literature Classification and punched-card system.
(A general, U8)

162-A. Light Metals in Heavy Demand. Clyde Williams. *Monthly Business Review,* v. 33, May 1951, p. 12.
Supply and demand situation, recent expansion in applications, and future prospects. (A4, Al, Mg)

163-A. Predicts Sharp Reduction in U. S. Lead Supply This Year With Imports Cut About 50 Per Cent. William B. Clancy. *Metals,* v. 21, Apr. 1951, p. 9, 12, 18.
(A4, Pb)

164-A. Integrated Waste Treatment System for the Electroplating Industry. Leslie E. Lancy. *Metal Finishing,* v. 49, Feb. 1951, p. 56-59.
A new system, on which a patent application is pending. 26 ref.
(A8, L17)

165-A. Recovery of Chromic Acid From Plating Rinse Waters. E. W. Neben and W. F. Swanton. *Plating,* v. 38, May 1951, p. 457-460, 470.
A package unit composed of glass-lined and stainless steel equipment for recovering waste. Economics of the process are analyzed in detail, and an equation for net annual profit is presented. Several examples of how to select the proper size unit and how to estimate net annual profit or amortization period.
(A8, L17)

166-A. Metals. William F. Boericke. *Automotive Industries,* v. 104, May 1, 1951, p. 55, 90, 92.
Price, supply, and demand situation: British advance metal prices; Zn demand continues strong; Sn outlook clouded; Pb prices may head upwards; little change in Cu; and peak demand for steel in May. (A4)

167-A. A Review of World Coal and Iron Ore Resources and Their Utilization for Manufacture of Steel. Part III. Steel Production of Various Nations—Major Steel Producers. Part IV. Other Minor Steel-Producing Nations. W. C. Rueckel. *Blast Furnace and Steel Plant,* v. 39, Apr. 1951, p. 426-438; May 1951, p. 540-548.
Includes bar graphs and maps. 15 ref. (A4)

168-A. An Accounting of World Mining for 1950. Charles Will Wright and John Beaupre Dorsh. *Mining World,* v. 13, Apr. 15, 1951, p. 27, 29-35.
An economic summary.
(A4, B12)

169-A. Metals and Minerals Review. *Mining World,* v. 13, Apr. 15, 1951, p. 37-44, 46-51.
The following brief articles review economic developments of 1950: "Aluminum," Donald M. White; "Antimony," James P. Bradley; "The Atom," staff of AEC's Raw Materials Operations Office; "Beryllium," D. H. Hershberger; "Cobalt," Howard Waldron; "Copper," W. W. Lynch; "Fluorspar," C. O. Anderson; "Gold," Neil O'Donnell; "Iron Ore," Verne D. Johnston; "Lead," George Mixter; "Manganese," J. Carson Adkerson; "Molybdenum," C. M. Loeb, Jr.; "Nickel," John F. Thompson; "Oil Shale," Boyd Guthrie; "Phosphate," Louis Ware; "Potash," H. B. Mann; "Perlite," E. P. Chapman, Jr., and John A. Wood; "Platinum," C. W. Engelhard; "Quicksilver," J.

Eldon Gilbert; "Silver," E. W. Conrad; "Tin," Robert J. Nekervis; "Tungsten," Worthen Bradley; "Titanium," Joseph H. Reid; and "Zinc," Ernest V. Gent. (A4)

170-A. United States Mining Report. *Mining World,* v. 13, Apr. 15, 1951, p. 55-62, 64-72.

Economic survey by states, territories, and areas. (A4, B12)

171-A. World-Wide Mining Report. *Mining World,* v. 13, Apr. 15, 1951, p. 73, 76-77, 79-80, 83, 85, 87-88, 90, 94-95, 97-100, 102, 104, 106.

Economic survey by areas and countries. (A4, B12)

172-A. Directory of Active Mining Operations. *Mining World,* v. 13, Apr. 15, 1951, p. 1D-46D, 163.

List of American mining properties presented alphabetically by states. Listings are made under the name of the operating company, the mine or the individual operator, depending upon the name under which the property is operated or commonly known. The list was compiled after a careful survey of some 6,000 mines and prospects, both active and dormant, in the U. S. and Alaska. (A10, B12)

173-A. Blast Furnace Lime as Plant Food. (In German.) Wolfgang Elbert. *Stahl und Eisen,* v. 71, Apr. 12, 1951, p. 391-393.

Finely-ground blast-furnace slag not only replenishes the lime in the soil, but also adds trace elements indispensable to the growth of vegetation. (A8)

174-A. (Book) **Metallurgy in Antiquity; A Notebook for Archeologists and Technologists.** R. J. Forbes. 480 pages. E. J. Brill, Oude Rijn, 33a Leiden, Holland. 19 guilders.

Surveys beginnings and development of metal winning and working from 7000 B.C. to 1400 A.D. Covers Au, Ag, Pb, Sn, Sb, As, Zn, brass, Cu, and Fe. Extensive chapter bibliographies. (A2)

175-A. (Book) **Materiaux de Construction Mécanique.** (Engineering Materials.) H. Wiegand. 304 pages. 1951. Dunod, 92 Rue Bonaparte, Paris 6, France. $7.50.

Translated into French, from the original German. Covers problems facing the design engineer. Without getting into the field of metallurgy, except where absolutely necessary, it describes the characteristics and composition of the various materials and operations which change their properties. (A general)

B

RAW MATERIALS AND ORE PREPARATION

125-B. Sintered Oxide Crucibles Withstand Temperatures Exceeding 2000° Centigrade. *Brick & Clay Record,* v. 118, Apr. 1951, p. 72-73.

Non-porous pure metallic oxides that are chemically and physically stable at high temperatures, and are useful as super-refractories. (B19)

126-B. Comminution Plant. (Continued.) F. Lebeter. *Mine & Quarry Engineering,* v. 16, Nov. 1950, p. 355-358; Dec. 1950, p. 391-394.

Concludes section on ball mills. The rod mill, gravity stamps, rolls, hammer mills, and the Lopulco crusher. Final installment: lubrication of crushing and grinding machinery. (B13)

127-B. Gold Milling in Southern Rhodesia; A Review of Current Practice. *Mine & Quarry Engineering,* v. 17, Apr. 1951, p. 121-122. (B13, Au)

128-B. Mining and Milling at Outokumpu, Finland. W. R. Bull. *Mine & Quarry Engineering,* v. 17, Apr. 1951, p. 123-127.

Details, including concentration flowsheets. The ore contains chalcopyrite, sphalerite, pyrite, and pyrrhotite, while the gangue is practically all quartz. Cu, Zn, Au, Ag, and pyrite are recovered. (B12, B13, Cu, Zn, Au, Ag)

129-B. Our Present Knowledge of the Effect of Slag Components on the Viscosity of Smelter Slags. (In German.) F. Brenthel. *Zeitschrift für Erzbergbau und Metallhüttenwesen,* v. 4, Feb. 1951, p. 55-61.

Effects of temperature and composition of steelmaking slags on viscosity, and practical examples of the effects of slag components. (B21, D general, ST)

130-B. New Research Results on the Suitability of Xanthates for Pb-Zn Ore Flotation, Based on an Example of Ruhr-Type Pb and Pb-Zn Sulfide Ores. (In German.) Friedrich Stolze. *Zeitschrift für Erzbergbau und Metallhüttenwessen,* v. 4, Feb. 1951, p. 68-76; disc., Mar. 1951, p. 95-98.

Laboratory and plant experiences. Previous theories. (B14, Pb, Zn)

131-B. Suspension Roasting of Zinc Blende in the Former Biesche A.G. (In German.) Hans Dürr. *Zeitschrift für Erzbergbau und Metallhüttenwesen,* v. 4, Mar. 1951, p. 89-95.

Development of the process, its principles, use, and practical results. Suspension-roasting plants are illustrated. (B15, Zn)

132-B. Concentration of Vanadium in the Beneficiation of Oolithic Iron Ores. (In German.) Helmut Kirchberg. *Zeitschrift für Erzbergbau und Metallhüttenwesen,* v. 4, Mar. 1951, p. 98-104.

Occurrence and abundance of V and the V content of iron ores. On the basis of results of concentration of several different Fe ores, it appears unlikely that V can be concentrated to a high degree by purely mechanical ore-dressing procedures. 10 ref. (B14, V, Fe)

133-B. Separation of Sulfur and Selenium. (In Russian.) M. G. Zhuravleva and G. I. Chufarov. *Zhurnal Prikladnoi Khimii* (Journal of Applied Chemistry), v. 24, Jan. 1951, p. 28-31.

Conditions of equilibrium between the liquid and vapor phases in the S-Se system were investigated. Results are of importance in the recovery of Se from flotation tailings from Cu ore beneficiation. It is also necessary to remove the Se from the S to make the latter suitable for certain uses. (B14, Se)

134-B. Fundamental Studies on Interfacial Tensions in Flotations. III. Tilting-Plate Method of Determining Contact Angle and the Wetting Tension of Aqueous Solutions of Frothers for Paraffin-Wax. IV. Suspended-Plate Method of Determining Wetting Tension and the Time Variation of Wetting Tension of Glass at Water-Air Interface. (In English.) Masayoshi Wada. *Science Reports of the Research Institutes, Tohoku University,* ser. A, v. 2, Feb. 1950, p. 102-149.

Details of methods and of extensive experimental measurements on a variety of reagents. 231 ref. (B14, P10)

135-B. On the Mechanical Pulverizing of Metals by a Special Designed Eddy Mill. (In English.) Tosihiko Okamura, Koji Inagaki, and Yosimichi Masuda. *Science Reports of the Research Institutes, Tohoku University,* ser. A, v. 2, Apr. 1950, p. 361-369.

Mill in which metals are crushed chiefly by shearing due to mutual friction. Its application to various metals and alloys. Relation between pulverizing work and pulverizing time; relation between crushing work and particle size; variation in particle-size distribution of mill product with treating time; structure of pulverized powders; oxidation of pulverized powder; and temperature rise during pulverizing. (B13, H10)

136-B. Iron Ore Supplies for Steel Production. *Mining Journal,* v. 136, Apr. 27, 1951, p. 393-394.

Plans to develop new iron ore deposits, e.g., in French West Africa and in Sierra Leone, as well as steps taken to lessen Britain's dependence on ore imports. (B10, Fe)

137-B. Testing of Sinter. E. G. Hill and Robert E. Powers. *American Iron and Steel Institute,* Preprint, 1951, 16 pages.

Survey of the literature indicates need for control tests to define sinter properties. Literature data on size, chemical analysis, strength, porosity, permeability, reducibility, magnetic analysis, and microstructure are correlated. A few of the methods have been tried on a laboratory scale and appear promising for control work. 57 ref. (B16, Fe)

138-B. Improving Current Practice in Blast Furnace Sintering. Robert E. Powers. *American Iron and Steel Institute,* Preprint, 1951, 27 pages.

Results of a subcommittee survey of current practice, during which an investigator spent about a year visiting 15 plants and studying their operation. 14 ref. (B16, Fe)

139-B. Operating Factors in Heavy-Media Processing. Part II. L. J. Erck. *Mining Congress Journal,* v. 37, Apr. 1951, p. 88-91.

Technical and economic factors, supplemented by tabular lists of heavy-media plants in operation and under construction for concentration of metallic and nonmetallic minerals and coal. (B14)

140-B. Extraction of Alumina From Haiti and Jamaica Bauxites. T. D. Tiemann. *Journal of Metals,* v. 3, May 1951; *Transactions of the American Institute of Mining and Metallurgical Engineers,* v. 191, 1951, p. 389-393.

Chemical and mineralogical composition of Caribbean bauxite ores. Extraction of alumina by several processes from both Haiti and Jamaica bauxites. (B14, Al)

141-B. Electric Equipment for Heavy-Media Separation Process. J. J. Bean and K. A. Blind. *Transactions of the American Institute of Electrical Engineers,* v. 69, pt. 2, 1950, p. 1421-1429.

Includes flow diagrams of the entire heavy-media separation plant, as well as diagrams of the separating equipment itself. Operating data on the Dings high-intensity Crockett-type submerged-belt magnetic separator. Tractive force on particles in a magnetic field is calculated. (B14)

142-B. Milling and Refining. *Canadian Mining Journal,* v. 72, Apr. 1951, p. 121-134.

Section of special issue on Kerr-Addison Gold Mines, Ltd. The ore, the mill building, the flow sheet and each of its features, refining, handling of supplies, metallurgical control, research, and personnel. (B13, B14, Au)

143-B. Refractories Problems in Industry. T. P. Mann. *Australasian Engineer,* v. 44, Feb. 7, 1951, p. 83-88.

Approach to the subject from the consumer's point of view. Considerable attention is paid to metallurgical applications. (B19)

144-B. The Uses of Graphite and Carbon in the Engineering and Metallurgical Industries. R. Ogilvy. *Australasian Engineer,* v. 44, Jan. 8, 1951, p. 80-89.

Emphasizes refractory uses as mold-surfacing agents, as linings for chemical-plant equipment, electrical and mechanical applications. (B19, C)

145-B. Refractory Concrete; Some Industrial Applications in Furnace Construction. A. E. Williams. *Iron and Steel*, v. 24, May 1951, p. 160-162.

Typical examples of applications and advantages. Crushing strength, thermal conductivity, and refractoriness under load. (B19)

146-B. Investigation of the Effects of Controlled Variables on Sinter Quality. Part I. Development of Experimental Sinter Plant and Preliminary Results Using Northants Ore. E. W. Voice, C. Lang, and P. K. Gledhill. *Journal of the Iron and Steel Institute*, v. 167, Apr. 1951, p. 393-399.

A sinter pan 2 ft. square was set up using suction from a production Fe sinter plant. Sinter was produced from weighed mixes, the sinter process was observed and the sinter made was examined. Quantitative results show effects on flue dust, returned fines, and coke on sinter strength. Correlation was obtained between effect of moisture content and suction on speed of sintering; and observations were made of bed porosity and air flow before and during sintering. Effects of various fuels. (B16, Fe)

147-B. The Sintering of Northamptonshire Iron Ore; A Production-Plant Study of Factors Affecting Sinter Quality. D. W. Gillings, E. W. Voice, C. Lang, and P. K. Gledhill. *Journal of the Iron and Steel Institute*, v. 167, Apr. 1951, p. 400-439.

Effects and relative importance of factors governing physical properties of the sinter. Control of proportions and properties of raw materials was most important, carbon content of the raw mixture being especially critical. Efficiency of mixing and exclusion of large fragments of ore and coke were next in importance, followed by control of content of returned sinter and of water in the mixed raw materials. Variations of suction had very little effect. (B16, Fe)

148-B. Viscosity Measurements on Synthetic Slags of the System $FeO-SiO_2-TiO_2$. (In French.) Georges Urbain. *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, v. 232, Jan. 22, 1951, p. 330-332.

Technique, apparatus, and results. (B21, ST)

149-B. Preparation of Uranium Metal at the Couchet Plant of the Atomic Energy Commission. (In French.) Charles Eichner, Bertrand Goldschmidt, and Paul Vertes. *Bulletin de la Société Chimique de France*, Jan.-Feb. 1951, p. 140-142.

Purification of uranium compounds leading to production of the oxide. The plant process for the preparation of uranium metal by the action of Ca on UF_4. 19 ref. (B14, C4, U)

150-B. The Iron Ore Problem in the Western Hemisphere. (In German.) Kurt Emil Dittmann. *Archiv für das Eisenhüttenwesen*, v. 22, Mar.-Apr. 1951, p. 73-83.

Survey of assured and possible iron resources, supplemented by numerous maps and tables showing distribution, annual production, composition, and mining costs. 16 ref. (B10, A4, Fe)

151-B. How U.S.V.'s Pine Creek Mine Will Increase Tungsten Output. H. L. McKinley, T. W. Holmes, and L. E. Sausa. *Engineering and Mining Journal*, v. 152, May 1951, p. 76-83.

Mining, milling, and concentration procedures. Includes flow diagrams. Products are W, Mo, and Cu concentrates. (B12, B13, B14, W, Mo, Cu)

152-B. How Granby Increased Mill Capacity by More Than 78%. John Huttl. *Engineering and Mining Journal*, v. 152, May 1951, p. 84-86.

How mill capacity was increased to match greater ore production from the mine of Granby Consolidated Mining, Smelting & Power Co., Ltd. Includes flow sheets of the crushing plant, the grinding section, and the flotation section. Cu concentrates are produced. (B13, B14, Cu)

153-B. Concentration of Oxide Manganese Ores From Lander County, Nev. T. F. Mitchell, R. R. Wells, and W. G. Sandell. *U. S. Bureau of Mines*, Report of Investigations 4780, Apr. 1951, 16 pages.

This deposit is a replacement of sedimentary rock by manganese oxides. Ore occurs in two main ore bodies, which can be mined separately. Laboratory experiments were made on samples from each body. Beneficiation test results and conclusions as to commercial feasibility. (B10, B14, Mn)

154-B. Concentration of Ores by Induced Activities. F. E. Senftle and A. M. Gaudin. *Nucleonics*, v. 8, May 1951, p. 53-59.

How neutron-induced activity may be used as an aid in ore separation. Ore pickers controlled by radiation detectors may be used to isolate pieces of ore rich in particular elements. 10 ref. (B14)

155-B. Hot Metal Cars and Mixers —How to Extend Life of Refractory Linings. Part. I. R. P. Heuer and C. E. Grigsby. *Steel*, v. 128, Apr. 2, 1951, p. 93-94, 96.

Variations in service life, often unnoticed, cause accelerated lining wear in vessels for handling molten pig iron more often than lack of uniformity in the refractories themselves. New theory on rate of wear shows how more hot metal can be handled per lining. First of four articles. (To be continued.) (B1, Fe)

156-B. Research on the Effect of Ultrasonic Vibrations in Flotation Beneficiation. (In German.) Wilhelm Petersen. *Zeitschrift für Erzbergbau und Metallhüttenwesen*, v. 4, Feb. 1951, p. 62-68; Apr. 1951, p. 142-148.

Dispersing, emulsifying, and coagulating effects of ultrasonic vibrations generated by magnetostrictive and piezoelectric generators on the beneficiation of different ores. Practical uses of the method. 17 ref. (B14)

157-B. Selection of Different Washing Methods. (In German.) Theodor Eder. *Zeitschrift für Erzbergbau und Metallhüttenwesen*, v. 4, Apr. 1951, p. 137-142.

Experience and theory prove the superiority of washing of ores and materials with make-up water over that without make-up water. Different washing methods; typical data for quartz sand and galena are tabulated and charted. (B14)

158-B. (Book) **Silicate Melt Equilibria.** Wilhelm Eitel. 159 pages. 1951. Rutgers University Press, New Brunswick, N. J. (Translated from the German (1942 ed.) by J. G. Phillips, T. G. Madgwick, and R. B. Sosman, with revisions and additions by the author.)

Comprehensive monograph, including an introductory section and sections on binary, ternary, quaternary, and polynary systems. 92 ref. (B21)

C

NONFERROUS EXTRACTION AND REFINING

53-C. Making Aluminium Alloys at the Works of International Alloys Ltd. *Edgar Allen News*, v. 29, Apr. 1951, p. 832-835.

Procedures and equipment of British firm. Raw materials include virgin Al, process scrap, old scrap, and dross. (C21, A8, Al)

54-C. Continuous Casting Practice in the Non-Ferrous Industries. R. Chadwick and J. F. Hobbs. *Journal of the Birmingham Metallurgical Society*, v. 31, Mar. 1951, p. 13-24.

A general discussion. Includes micrographs and macrographs showing Al and Cu alloys. (C5, Al, Cu)

55-C. Aspects of Continuous Casting. D. R. Wood. *Journal of the Birmingham Metallurgical Society*, v. 31, Mar. 1951, p. 25-30.

Detailed consideration of thermal equilibrium in the open-mold continuous casting process, and conditions under which various metals and alloys may be cast by such a method. (C5, D9)

56-C. Physicochemical Problems in the Thermal Production of Zinc and Their Importance to Metallurgical Practice. (In German.) Kurt Hoffmann. *Zeitschrift für Erzbergbau und Metallhüttenwesen*, v. 4, Jan. 1951, p. 19-25; Mar. 1951, p. 104-109.

First part: thermal reduction of ZnO with CO and effect of an excess of CO and of inert gases on the reaction. Second and concluding part: practical possibilities of improving the output of horizontal muffle furnaces and advantages of briquetting the charge. 20 ref. (C21, Zn)

57-C. Dross Formation of Lead Melts in Calm Air. (In German.) W. Hofmann and K. H. Mahlich. *Werkstoffe und Korrosion*, v. 2, Feb. 1951, p. 55-68.

Experiments on effects of temperature, furnace atmosphere, and alloying additions on formation of dross from soft lead and its alloys. A new method of retarding this effect consists of heat treating the melt at 500-700° C. with frequent stirring. 25 ref. (C21, Pb)

58-C. Principles of the Equilibria Among Lead, Speiss, and Rock. (In German.) W. Lange. *Chemische Technik*, v. 3, Feb. 1951, p. 47-52.

Fundamental study of phase relationship among these materials, which are of importance in recovery of lead from arsenide ores. Numerous phase diagrams and tables. (C general, M24, Pb)

59-C. Electrolytic Tin Refining. C. W. Jensen. *Mining Magazine*, v. 84, Apr. 1951, p. 206-209.

Process involving use of Na_2S solution for refining crude tins containing as low as 70% Sn. (C23, Sn)

60-C. Refining Secondary Copper Alloys. Marvin Glassenberg, L. F. Mondolfo, and A. H. Hesse. *American Foundrymen's Society*, Preprint 51-65, Apr. 1951, 7 pages.

Experiments to determine rates of removal of common impurities from secondary Cu alloys by means of air injection, and to investigate effect of commercial O_2 on these rates of removal. (C21, A8, Cu)

61-C. Equilibria in the Dissociation of Be Iodide. Bernard Kopelman and Harry Bender. *U. S. Atomic Energy Commission*, AECU-1028, Apr. 5, 1951, 10 pages.

Experiments were performed to determine whether the large amounts of metal obtained by the cyclic iodide process, in which the iodide to be decomposed is thermodynamically stable with respect to decomposition into its elements, are due to upsetting of equilibrium only or can be explained by additional reactions. (C4, Be)

62-C. The Distillation of Ca and Mg. I. I. Betcherman and L. M. Pidgeon. *Canadian Mining and Metallurgical Bulletin*, v. 44, Apr. 1951, p. 253-263; *Transactions of the Canadian Institute of Mining and Metallurgy*, v. 54, 1951, p. 166-177.

Vacuum distillation of Mg and Ca, their separation from each other, and their separation from less volatile impurities. 22 ref. (C22, Ca, Mg)

63-C. The Effect of Ultrasonic Frequencies on Electrolytic Processes. II. The Stirring Effect of Ultrasonics. (In German.) Albert Roll. *Zeitschrift für Metallkunde*, v. 41, Nov. 1950, p. 413-417.

Results of quantitative experimental study for electrolytic separation of Ag and of Cu. (C28, Cu, Ni)

64-C. Yellow Pine Antimony Smelter. *Mining World*, v. 13, May 1951, p. 30-34.

At Bradley Mining Co.'s new electric smelter at Yellow Pine, Idaho, a six-step process produces Sb_2O_3, and recovers Au, Ag, Cu, and Pb. Includes flowsheet.
(C21, Sb, Au, Ag, Cu, Pb)

65-C. Remarks on the Article by K. Hoffman. "Physicochemical Problems in the Thermal Production of Zinc and Their Importance to Metallurgical Practice." (In German.) Hans Grothe. *Zeitschrift für Erzbergbau und Metallhüttenwesen*, v. 4, Apr. 1951, p. 133-137.

Critically discusses above paper. (Jan. and Mar. 1951 issues, see item 56-C, 1951.) (C21, Zn)

D

FERROUS REDUCTION AND REFINING

153-D. Combustion in the Open Hearth Furnace. J. M. Brashear. *Blast Furnace and Steel Plant*, v. 39, Apr. 1951, p. 421-425, 476.

Attempts to correlate ignition velocities, heating values, and maximum heat-delivery capacity for given combustion volumes. (D2)

154-D. Hazards of Back-Drafting. Owen R. Rice. *Iron and Steel Engineer*, v. 28, Apr. 1951, p. 118-122; disc. p. 122.

Proper procedure to be used in back-drafting of blast furnaces in order to avoid explosions. (D1, Fe)

155-D. Open Hearth Furnaces "Jet Tapped" in 30 Seconds. *Steel*, v. 128, Apr. 30, 1951, p. 64, 67, 78.

Full initial flow of steel reduces tapping time, taphole maintenance, and skull production and contributes to increased output of openhearth shop. Bazooka-type projectile is fired with complete safety. Procedure for assembling, storing, and detonating the castings device. (D2, ST)

156-D. Protect Blast Furnace Linings From Carbon Monoxide Disintegration. *Brick & Clay Record*, v. 118, Apr. 1951, p. 84, 87.

Treatment of brick-work with sulfur and chloride compounds either by soaking, dipping, spraying, or adding the chemical to the bonding material. (D1)

157-D. Refractories From the User's Point of View. W. L. Kerlie. *Refractories Journal*, v. 27, Mar. 1951, p. 84-95; disc. p. 95-96.

Factors influencing the choice of refractory material. Performance from the point of view of iron and steel production. Recent developments and trends insofar as blast furnaces, coke ovens, mixers, basic bessemer converters, casting practice, and reheating furnaces are concerned. Special consideration to openhearth bottoming and fettling consumption and the serious effect of the hearth-metal reaction, particularly with the more highly oxidized (or low-carbon) steels. Suggested that the FeO in the liquid steel is one of the major factors leading to hearth erosion.
(D general, ST)

158-D. Ingot Moulds; Practical Aspects of the Quasi-Bessemerizing Process. W. S. Williams. *Iron and Steel*, v. 24, Apr. 1951, p. 113-114, 123.

Apart from accidental causes there are three major factors which limit the lives of closed-end molds: soft bases, cracking, and crazing. The first cause can be eliminated by one of two methods—the quasi-bessemerizing process or the use of steel plates. Factors influencing the choice of method. (D9, ST)

159-D. Steel Composition and Ingot Cracks. G. Reginald Bashforth. *British Steelmaker*, v. 17, Apr. 1951, p. 198-202.

Adverse effects of residual elements in rolling properties of steel, the phenomenon of peritectic change, and cracking caused by sulfur both in the ingot stage and during subsequent cogging. Reviews the more important production checks in controlling incidence of the defects described. (D9, F21, ST)

160-D. Operation of a Large French Blast Furnace. (In French.) J. Cyther and A. Denys. *Revue de Metallurgie*, v. 48, Feb. 1951, p. 73-84.

Installation and operation of a blast furnace with a crucible 6.50 m. in diam. (D1, Fe)

161-D. Refining of Phosphorus Cast Iron by Oxygen in the Openhearth Furnace. (In French.) G. Husson and P. Bettembourg. *Revue Métallurgie*, v. 48, Feb. 1951, p. 135-139.

Results of systematic investigation on an industrial scale. The wide possibilities of this method are emphasized. (D2, CI)

162-D. Investigations of Oxygen-Enriched Blast in Bessemer Converters. (Concluded.) (In French.) P. Leroy and E. Devernay. *Revue de Métallurgie*, v. 48, Feb. 1951, p. 140-158; disc. p. 158.

Influence of O_2 enrichment on blast conditions, inconvenience of use of a blast enriched with 40% O_2, and consumption of injected O_2. Indicates that the optimum amount of O_2 is about 30%. Complete details of experimental results are tabulated in an appendix. 16 ref.
(D3, ST)

163-D. Steelmaking for Castings. John Howe Hall. *Foundry*, v. 79, May 1951, p. 101, 222-229.

Openhearth furnace refractories and constituents of the metal charge. Third of a series. (To be continued.)
(D2, ST)

164-D. Is the Reduction of Iron Ore by Hydrogen a Commercial Possibility? *Metal Progress*, v. 59, Apr. 1951, p. 523-526.

Companion articles by P. E. Cavanagh and Harry W. McQuaid present pessimistic and optimistic viewpoints, respectively. (D8, Fe)

165-D. SiO in Acid Steel. *Metal Progress*, v. 59, Apr. 1951, p. 552, 554, 556. (Translated and condensed from "Silicon Monoxide in the Melting of Acid Steel", P. V. Gel'd, A. I. Kholodov, and N. M. Buinov.

Previously abstracted from *Doklady Akademii Nauk SSSR* (Reports of the Academy of Sciences of the USSR). See item 142-D, 1950.
(D5, M21, ST)

166-D. Jet Tapping. Harold Walker and A. Robert Almeida. *Journal of Metals*, v. 3, May 1951, p. 374-376.

New development at Republic Steel Corp. A shaped explosive charge is used to tap the openhearth. Nearly 2500 units have been fired to date, with only occasional failures. (D9, D2, ST)

167-D. Safety Precautions in Jet Tapping. R. H. Ferguson. *Journal of Metals*, v. 3, May 1951, p. 377-378.

See item 166-D, above. (D9, D2, ST)

168-D. Structure of the Yellow Crystalline Fracture of Blast-Furnace Salamander. John R. Weeks, Dan McLachlan, Jr., and John R. Lewis. *Journal of Metals*, v. 3, May 1951; *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 191, 1951, p. 393-394.

During operation of the iron blast furnace, aggregates of hard, infusible, yellow, cubic crystals frequently form in the interstices of the lining and on the hearth of the furnace. These were first examined by Wohler and were identified as a complex cyanonitride of Ti, having the formula $Ti(CN)_2 \cdot 3Ti_3N_2$. Analytical and spectrographic work indicates that this compound does not exist. (D1, M26, Fe)

169-D. Vertical Solidification of Steel Ingots Studied. J. W. Spretnak. *Iron Age*, v. 167, May 3, 1951, p. 107-110.

Shows that heat removal in transverse solidification occurs by radiation while, in vertical solidification, both radiation and conduction take place. Vertical solidification, particularly in the lower portion, determines nature of segregation and extent of "A" and inverted "V" porosity patterns. (D9, N12, ST)

170-D. Oxidation Practice in Acid Electric Steel Melting Furnaces. *Industrial Heating*, v. 18, Apr. 1951, p. 647, 648, 650.

Summarizes "Oxygen Practice", by R. H. Jacoby and J. H. Garrison; and "Ore Practice", by F. J. Stanley and W. L. Doyle. These papers were presented at the Acid Session on Oxidation of the Electric Furnace Steel Conference, AIME, Dec. 7-9, 1950, in Pittsburgh. (D5, ST)

171-D. Cold Metal and Basic Foundry Practice. I. *Industrial Heating*, v. 18, Apr. 1951, p. 654, 656, 658, 660.

Summarizes two papers presented at a session of 33rd National Open Hearth Conference of the AIME, Cincinnati, Ohio: "The Use of Graphite in Cold Metal Changes", Clyde B. Jenni; and "Quality of Raw Materials", Gordon McMillin and John R. Patton. (D2, ST)

172-D. Zebra Type Open-Hearth Roof Steps Up Heats Per Campaign. *Steel*, v. 128, May 7, 1951, p. 126, 128.

Increased openhearth steel production has been made possible by development of the above roof which incorporates silica and basic brick in alternate courses. The silica brick, which have high strength, insure a mechanically stable roof; the basic brick, which have superior resistance to chemical attack, wear away more slowly and protect the silica brick. The result is a roof which is intermediate in cost and durability between one made of 100% silica and one made entirely of basic brick.
(D2, ST)

173-D. Ladle Refractories and Practice in Acid Electric Steel Foundry. Clyde H. Wyman. *American Foundrymen's Society*, Preprint 51-64, Apr. 1951, 7 pages.

Properties and mixes of ganisters for the linings of various parts of foundry ladles, their installation, drying, and preheating. Designs for stoppers, nozzles, and ladles. (D9)

174-D. Direct Reduction of Iron Ore Using the Fluidized Solids Technique. M. Tenenbaum and C. M. Squarcy. *American Iron and Steel Institute*, Preprint, 1951, 32 pages.

The fluidized-solids approach to the handling of finely divided materials provides conditions of gas-solid contact that appear ideal for promoting the reactions involved in the direct reduction of iron ores. Reduction tests in the static and

fluidized states were conducted on six different iron oxide bearing materials. The static tests provided basic data on reduction characteristics of the various oxides. In most of the experiments it was possible to obtain and maintain a fluidized system and to effect some reduction; however, complete reduction was seldom approached and never attained. (D8, Fe)

175-D. Significance of Air Temperature in Open Hearth Operation. John S. Marsh. *American Iron and Steel Institute,* Preprint, 1951, 16 pages.

A measuring device was designed and built that proved to be an extraordinarily sensitive tool for diagnosing furnace behavior. A principal finding is that air temperature has large influence on heat time, to the extent that heat time is inversely proportional to air temperature. For a given furnace and range of fuel input, the principal determiner of air temperature is air leakage. Judging by operating records, most openhearth furnaces are deficient in air temperature. (D2, S16, ST)

176-D. Oxygen as a Means of Increasing Bessemer Production. W. G. McDonough. *American Iron and Steel Institute,* Preprint, 1951, 18 pages.

Procedures, equipment, and results of plant-scale experiments in an acid bessemer converter at National Tube Co.'s National Works Plant, McKeesport, Pa. (D3, ST)

177-D. The Effect of Sinter on Blast Furnace Production as Determined by Analysis of Daily Operating Data. W. E. Marshall. *American Iron and Steel Institute,* Preprint, 1951, 11 pages.

Various factors affecting blast-furnace operation, of which sinter is only one. Results of a statistical study using 1000 daily values. (D1, Fe)

178-D. Cleaning Ferromanganese Blast Furnace Gas. C. A. Bishop, A. H. Brisse, R. G. Thompson, C. R. Liebel, and W. A. Swaney. *American Iron and Steel Institute,* Preprint, 1951, 16 pages.

The dust found in ferromanganese blast-furnace gas is of two types. One type, comprising about 20% of the dust present, consists of particles of about 20 microns in size. This fraction is removed by a conventional dust catcher. The other type, which amounts to 80% of the solids present, is a typical fume, with particle sizes varying from 0.10 to 1.0 micron. A practical method is developed for removing and disposing of this fume. Preliminary and laboratory tests, of three types of equipment; the briquetting process adopted; pilot-plant work; spray conditioning; electrical precipitation; burning; leaching; filtration; and drying. (D1, A8, Fe)

179-D. Ironstone; Drying Procedure at Appleby-Frodingham. R. C. Walthew. *Iron and Steel,* v. 24, May 1951, p. 157-159.

Previously abstracted from condensed version with similar title appearing in *Metallurgia.* See item 111-D, 1951. (D1, Fe)

180-D. Italian Steel; Features of Some Northern Works. J. M. Butler. *Iron and Steel,* v. 24, May 1951, p. 163-167.

Features of five Italian steelmaking plants, including ore preparation, blast furnace and electric reduction, bessemer, openhearth, electric and induction refining. (D general, B general, ST)

181-D. Significance of Equilibrium and Reaction Rate in the Blast-Furnace Process. J. B. Austin. *Journal of the Iron and Steel Institute,* v. 167, Apr. 1951, p. 358-363.

Some of the ways in which physicochemical methods are useful in investigating the blast furnace process. On the basis that all the reduction is "indirect", it is possible to set up a thermodynamically ideal, isothermal process, operating at minimum consumption of carbon. Comparison of this minimum with the amount of carbon required as fuel indicates that, in a furnace producing the common grades of Fe from Mesabi ores, the requirement for carbon is determined primarily by the need for a reducing agent. 13 ref. (D1, Fe)

182-D. Joint Discussion on the Papers: "The Thermodynamic Background of Iron and Steel Making Processes. Part I. The Blast-Furnace," F. D. Richardson and J. H. E. Jeffes; and **"The Influence of Gas/Solid Temperature Differences on Blast Furnace Operation,"** J. Taylor. *Journal of the Iron and Steel Institute,* v. 167, Apr. 1951, p. 378-382. (D1, Fe)

183-D. Joint Discussion on the Papers: "Blast-Furnace Gas Cleaning. An Analysis of Plant Performance," R. F. Jennings; and **"Blast-Furnace Gas Cleaning. Methods for Calculating the Motions of Particles in a Gas,"** J. Stringer. *Journal of the Iron and Steel Institute,* v. 167, Apr. 1951, p. 383-387. (D1, Fe)

184-D. Joint Discussion on the Papers: "Proposals for the Modification of a Blast-Furnace Top to Give Controlled Burden Distribution," E. L. Diamond; and **"A New Blast-Furnace Stock-Rod Gas Seal,"** E. J. Walklate. *Journal of the Iron and Steel Institute,* v. 167, Apr. 1951, p. 387-392. (D1, Fe)

185-D. Evaluating Different Fuels. (In German.) Friedrich Lüth. *Stahl und Eisen,* v. 71, Mar. 29, 1951, p. 327-334.

A comparative study of combustion efficiency of nine steelworks fuels under a variety of conditions. (D general, ST)

186-D. Evaluation of the Economics of Materials in the Basic Bessemer Process With the Aid of Energy-Balance Computations. (In German.) Eduard Senfter, Gerhard Schnürch, and Helmut Guthmann. *Stahl und Eisen,* v. 71, Mar. 29, 1951, p. 334-343.

Includes experimentally determined tables, graphs, and nomograms on the basis of which a given plant can evaluate its energy consumption and suitability of charge, also of furnace design, and take necessary steps to reduce costs of operation. 13 ref. (D3, ST)

187-D. Influence of Concentration of Carbon Monoxide in Gases on Reducibility of Iron Ores and Agglomerates. (In Russian.) L. M. Tsylev. *Izvestiya Akademii Nauk SSSR* (Bulletin of the Academy of Sciences of the USSR), Section of Technical Sciences, Jan. 1951, p. 74-79.

Rate of reduction of certain Fe ores and agglomerates obtained from them at different temperatures and concentrations of CO in the gaseous mixtures ($CO + Co_2 + N_2$) and ($CO + N_2$). Method of investigation and experimental data for different ores and gas mixtures. (D1, Fe)

188-D. Peculiarities in Behavior of Carbonaceous Manganese Ores in the Blast Furnace Process. (In Russian.) A. L. Zagyanskii. *Doklady Akademii Nauk SSSR* (Reports of the Academy of Sciences of the USSR) new ser., v. 76, Feb. 11, 1951, p. 721-722.

The influence of carbonaceous Mn ore additions on viscosity of a slag of the composition 23.9% SiO_2, 22.57% CaO, 14.8% MnO, 20.6% FeO, 4.67% Al_2O_3, and 6.35% MgO was determined. Method of investigation and results. (D1, Fe)

189-D. Instrumentation and Automatic Reversal System on Open Hearth Furnaces. C. E. Mortensen. *Blast Furnace and Steel Plant,* v. 39, May 1951, p. 533-539. (A condensation.)

System applied to each of the 30 openhearth furnaces in the Lackawanna, N. Y., plant of Bethlehem Steel Co. (D2, ST)

190-D. Status and Development of the Converting Process. (In German.) Walter Bading. *Stahl und Eisen,* v. 71, Apr. 12, 1951, p. 373-386; disc., p. 386-388.

Historical development of steel refining and statistical data to show that the earth's coal resources are insufficient to smelt existing iron ores. Recent experiments with the low-stack furnace and the high-pressure process in the blast furnace. Refining in the hearth furnace or the converter, and improving the properties of converted steel. Costs of operating different refining plants and possibilities of producing a low-nitrogen basic converter steel with properties similar to those of openhearth steel. 26 ref. (D1, D2, D3, Fe, ST)

191-D. (Book) **Modellgesetze der Vergasung und Verhüttung.** (Model Laws of Gasification and Smelting.) Sergei Traustel. 88 pages. 1949. Akademie-Verlag, Berlin, Germany. (Scientia Chimica, Bd. 4.)

Application of the theory of similarity to chemical reactions and their secondary physical phenomena. Expands the theory previously confined to physics to the above fields. (D general, C21)

E FOUNDRY

248-E. Machines Make Shell Molds Automatically. William Czygan. *Iron Age,* v. 167, Apr. 19, 1951, p. 81-85.

Method and advantage of the process. Machine will take patterns up to 3000 lb., 3 in. thick, area 26 x 41 in.; and completes the molding cycle in 50-70 sec. (E19)

249-E. How to Set Up a Precision Casting Foundry. W. F. Davenport and Adolph Strott. *Iron Age,* v. 167, Apr. 19, 1951, p. 90-94.

See abstract of "Procedures Used in Precision Casting Foundry", *CADO Technical Data Digest,* item 80-E, 1951. (E15)

250-E. How to Handle Magnesium-Zirconium Casting Alloys. L. J. G. van Ewyk. *Modern Metals,* v. 7, Apr. 1951, p. 48-49.

How a Dutch company casts new alloys based on Mg. (E general, Mg)

251-E. Foundry Modernization Expands Gray Iron Casting Capacity. *Steel,* v. 128, Apr. 30, 1951, p. 60-62.

National Supply Co.'s Engine Div. plant, Springfield, Ohio. (E11, CI)

252-E. Moulds and Cores; Types of Drying Systems Available in the Foundry. G. T. Hampton and W. H. Taylor. *Iron and Steel,* v. 24, Apr. 1951, p. 117-121.

Previously abstracted from "Drying of Foundry Moulds and Cores," *Engineering.* See item 153-E, 1951. (E19, E21)

253-E. Basic Principles of Die Design; Provisions for Control of Die Temperature. H. K. Barton and L. C. Barton. *Machinery* (London), v. 78, Mar. 29, 1951, p. 528-535.

Typical arrangements for control of die temperature in die-casting designs. (E13)

254-E. G. & J. Weir's Foundry and Heat-Treatment Facilities. *Foundry Trade Journal,* v. 90, Mar. 29, 1951, p. 333-334, 343.

Plant which manufactures auxiliary machinery for marine and land engineering. (E general, J general)

255-E. Technical Control Emphasized at a Rochester Foundry. *Foundry Trade Journal,* v. 90, Mar. 29, 1951, p. 335-340.

Procedures and equipment of British foundry. Both ferrous and nonferrous castings are produced. (E general)

256-E. Running and Feeding of Castings. H. S. Farmer. *Foundry Trade Journal,* v. 90, Apr. 5, 1951, p. 357-361; disc. p. 361-362.

Materials and design principles, clarified by schematic diagrams. (E23)

257-E. Casting of "Heavy" Metals. (In German.) E. Tofaute. *Giesserei,* v. 38 (new ser., v. 4), Mar. 22, 1951, p. 121-124.

Emphasis on Cu, Zn, Sn, and Pb, especially Cu. Effects of atmospheric moisture and of SO_2 released from coke used as a fuel in crucible melting. Effects of H_2 on properties of the castings. (E general, EG-a)

258-E. Production of Die-Cast Light-Metal Field-Glass Bodies. (In German.) G. Lieby. *Giesserei,* v. 38 (new ser., v. 4), Mar. 22, 1951, p. 128-130.

A Mg alloy containing 9% Mn is used. (E13, T8, Mg)

259-E. Designing Beryllium-Copper Investment Castings. John T. Richards. *Machine Design,* v. 23, May 1951, p. 121-125.

Previously abstracted from *Product Engineering.* See item 104-E, 1951. (E15, Q general, P general, Cu)

260-E. Use of Compressed Air Speeds Production of Die Cast Parts. *Machine and Tool Blue Book,* v. 47, June 1951, p. 138, 140, 142, 146, 148, 150, 154, 156, 158, 160, 162.

Various applications. (E13)

261-E. Metal Penetration. S. L. Gertsman. *Foundry,* v. 79, May 1951, p. 84-89.

For years foundrymen have been seeking to prevent the surface roughness produced when molten metal is forced for a considerable distance into the interstices between the sand grains. Suggests several procedures for correcting the condition. Experimental technique used to determine the effects of various factors. Results obtained with steel castings, with some references to bronze and cast iron. (E25, CI, Cu)

262-E. Lufkin Gray Iron Foundry Serves Industrial Southwest. William G. Gude. *Foundry,* v. 79, May 1951, p. 90-93, 165-166, 168.

Plant located in Lufkin, Tex. (E11, CI)

263-E. Melting Practices for Magnesium Alloys. (Concluded.) K. S. Sealander. *Foundry,* v. 79, May 1951, p. 94-95, 204-207.

Recommended procedures on the basis of work at Aluminum Co. of America. (E10, Mg)

264-E. Aluminum Alloy Die Castings. (Concluded.) Floyd A. Lewis. *Foundry,* v. 79, May 1951, p. 96-100, 230-235.

Die design and construction, design of Al die castings, their trimming, and finishing. Recommendations on inspection and quality control and on how to set up a plant for die-casting production. (E13, Al)

265-E. Olivine Sand Research. Gilbert S. Schaller and W. A. Snyder. *Foundry,* v. 79, May 1951, p. 104-105, 168, 170.

Experiments by the University of Washington with an olivine-base synthetic molding sand. Scarcity of silica-sand deposits on the West Coast, coupled with presence of large deposits of high-quality olivine rock in the state of Washington, prompted the investigation. (E18)

266-E. The Cup, Saucer, and Spoon. Pat Dwyer. *Foundry,* v. 79, May 1951, p. 106-109.

For many years, apprentice foundrymen have been required to make a one-piece casting consisting of above three pieces in their usual positions, before being considered fully trained. Various steps involved in forming the mold for this complex casting. (E19)

267-E. Melting Tin Bronze in Indirect Arc Electric Furnaces. Bruce W. Schafer. *Foundry,* v. 79, May 1951, p. 132, 135.

Recommended procedure. Various types of defects due to poor practice are illustrated. (E10, Cu)

268-E. How to Use the Cupola. Bernard P. Mulcahy. *Foundry,* v. 79, May 1951, p. 180.

Need for accurate weighing of charges and method of calculating charges. (Fifth of a series.) (To be continued.) (E10, CI)

269-E. Properties of Molding Sands. *Foundry,* v. 79, May 1951, p. 182, 184. (E18)

270-E. Die Casting Magnesium Alloys. R. C. Cornell. *American Foundryman,* v. 19, Apr. 1951, p. 75-77.

Recommended procedures, including trimming and finishing. Applications and relative cost factors. (E13, Mg)

271-E. Degas Molten Metals With Inert Gas. E. F. Kurzinski. *American Foundryman,* v. 19, Apr. 1951, p. 78-81.

Equipment and procedures developed by Linde Air Products Co. Since earlier work was reported many improvements have been developed. (E25)

272-E. Core Oil Evaluation Method. A. E. Murton, H. H. Fairfield, and B. Richardson. *American Foundryman,* v. 19, Apr. 1951, p. 85-89.

A comparative investigation of 19 commercial core oils, and several prospective binder materials in the sand laboratories of the Mines Branch at the request of the Steel Castings Institute of Canada. Features include: addition of heating elements at the bottom of the laboratory core oven, and installation of a positive adjustable draft system; a method of assessing core oils by oak-tree contour curves for comparing baking characteristics of two or more binder materials; effects of humid storage on strength of baked cores; and effects of high oven humidities on baked strength of core oils. (E18)

273-E. Evaluate Metal Penetration Variables. S. L. Gertsman. *American Foundryman,* v. 19, Apr. 1951, p. 94-99.

See abstract of "Metal Penetration," *Foundry,* item 261-E, 1951. (E, CI, Cu)

274-E. Small Air Rammers Replace Vibrators. *American Foundryman,* v. 19, Apr. 1951, p. 99.

Core rejections on production runs became negligible after small air-driven scaling tools were substituted for vibrators on a complicated core-drawing job. (E21)

275-E. What's Ahead for Non-Ferrous Foundries in Defense Work? W. A. Mader. *American Foundryman,* v. 19, Apr. 1951, p. 105-106.

Future prospects. Technological as well as economic developments. (E general, A4, EG-a)

276-E. Heat Flow in Moist Sand. Victor Paschkis. *American Foundrymen's Society,* Preprint 51-3, Apr. 1951, 10 pages.

Experiments to obtain some theoretical concepts related to the casting of metals. 17 ref. (E18)

277-E. Improvement of Machinability in High-Phosphorus Gray Cast Iron. Part II. W. W. Austin. *American Foundrymen's Society,* Preprint 51-12, Apr. 1951, 8 pages.

Additional results of an investigation carried out at Southern Research Institute. Foundry-scale applications of desulfurization + Zr-addition treatment, and performance data including cost estimates and results of tool-life machinability tests. 11 ref. (E25, G17, CI)

278-E. Metal Penetration. S. L. Gertsman and A. E. Murton. *American Foundrymen's Society,* Preprint 51-16, Apr. 1951, 8 pages.

Progress in an investigation of metal penetration of green sand cores. Procedure, effect of metal head and temperature, effect of core composition, and effect of silica flour additions. Possible mechanism involved. Metallographic examination. See also item 261-E, 1951. (E25)

279-E. Freezing of White Cast Iron in Green Sand Molds. H. A. Schwartz and W. K. Bock. *American Foundrymen's Society,* Preprint 51-17, Apr. 1951, 5 pages.

Time-temperature relations at the geometric center of white cast iron specimens before, during, and after freezing in green sand molds. (E25, N12, CI)

280-E. Oxidation-Reduction Principles Controlling the Composition of Molten Cast Irons. R. W. Heine. *American Foundrymen's Society,* Preprint 51-18, Apr. 1951, 17 pages.

Principles regulating composition changes in laboratory-melted cast iron. These principles are extended to the cold-melt air furnace melting process employing an acid lining. (E10, CI)

281-E. Compaction Studies of Molding Sands. R. E. Grim and Wm. D. Johns, Jr. *American Foundrymen's Society,* Preprint 51-19, Apr. 1951, 5 pages.

The compaction characteristics of Illinois fireclay, Illinois illite, Wyoming bentonite, and Mississippi bentonite-bonded sands were studied, using varying ratios of sand-clay-water. Compaction characteristics were correlated with differences in gross bulk densities. Relationships among compactability, gross bulk density, maximum green strength, and dry strength. (E18)

282-E. Solidification of Steel From Sand and Chill Walls. H. F. Bishop, F. A. Brandt, and W. S. Pellini. *American Foundrymen's Society,* Preprint 51-21, Apr. 1951, 13 pages.

Experimental thermal studies show that solidification proceeds in wave-like fashion. Thermal characteristics of the mold walls determine rate and mode of travel of these waves. Effects of wall thickness and superheat of the metal. (E25, N12, CI)

283-E. Solidification of Gray Iron in Sand Molds. R. P. Dunphy and W. S. Pellini. *American Foundrymen's Society,* Preprint 51-22, Apr. 1951, 9 pages.

Experimental thermal studies show that solidification proceeds in a wave-like fashion by the travel of "start" and "end-of-freeze" waves. The modifying effects of superheat, carbon equivalent, and sea coal. (E25, N12, CI)

284-E. Scab Defect on Gray Iron Castings. *American Foundrymen's Society,* Preprint 51-23, Apr. 1951, 8 pages.

Progress report of AFS committee gives results of experiments using 47 different sands for the molds. Differences in scabbing and non-scabbing sands are tabulated. Foundry conditions that promote scabs are listed. (E19, CI)

285-E. Effect of Sand Grain Distribution on Casting Finish. H. H. Fairfield and James MacConachie. *American Foundrymen's Society,* Preprint 51-24, Apr. 1951, 5 pages.

Six different types of sand-grain distribution patterns were produced by blending screened Si sands. Bronze was cast in the molds, which were made with different degrees of ramming, using a precision laboratory molding machine. Results

indicated effect of average grain size and of permeability on casting smoothness. The true flowabilities of the different sands are also indicated. (E19, Cu)

286-E. Precoat Materials for Investment Casting. Wm. F. Davenport and Adolph Strott. *American Foundrymen's Society,* Preprint 51-27, Apr. 1951, 8 pages.

Various ceramic oxides, alumina, silica, Zr silicate, and magnesia were evaluated by casting a heat resistant alloy, a stainless steel, and an alloy steel into precoated molds. (E15, AY, SS, SG-h)

287-E. Testing of Sand Under Impact. Wm. H. Moore. *American Foundrymen's Society,* Preprint 51-30, Apr. 1951, 10 pages.

Experiments with a simple apparatus using the Izod impact test. Results were applied to high-temperature behavior of sands. Further results using a more elaborate and substantial piece of equipment. (E18)

288-E. Equipment and Methods of Straightening and Dimensional Inspection of Malleable Iron Castings. Leslie N. Schuman. *American Foundrymen's Society,* Preprint 51-31, Apr. 1951, 7 pages. (E24, S14, CI)

289-E. Melting Aluminum and Magnesium-Base Alloys. L. W. Eastwood. *American Foundrymen's Society,* Preprint 51-32, Apr. 1951, 12 pages.

Melting practice, including types and selection of melting equipment, furnace designs, selection of pots and crucibles, and maintenance of tools. Various methods of melting these alloys. (E10, Al, Mg)

290-E. Basic Cupola Melting and Its Possibilities. E. S. Renshaw. *American Foundrymen's Society,* Preprint 51-41, Apr. 1951, 6 pages.

Use of a basic-lined cupola as part of a production unit; experience gained in operating with basic slags. Slag conditions which favor desulfurization to low limits also give high carbon pickup in low-carbon charges. The possibility of taking advantages of these factors, with particular reference to nodular iron production. Water cooling as a means of reducing refractory erosion. (E10, CI)

291-E. Some Effects of Temperature and Melting Variables on Chemical Composition and Structure of Gray Irons. E. A. Lange and R. W. Heine. *American Foundrymen's Society,* Preprint 51-47, Apr. 1951, 15 pages.

A study of some fundamental melting phenomena. Variables studied affecting chemical composition were air oxidation in various refractories, effect of temperature on composition changes, influence of slags, Fe oxide, rusty scrap, coke, and results of melting under a CO atmosphere. Structural changes were shown to be related to oxidizing melting conditions. Principles of temperature-dependent chemical reactions causing composition and structural changes. (E10, M27, CI)

292-E. Modern Core Sand Practice. R. H. Greenlee. *American Foundrymen's Society,* Preprint 51-59, Apr. 1951, 5 pages.

How core binders such as resins, and fast baking, highly polymerizing core oils, can be successfully incorporated into a well-balanced core-sand mix which will produce a desirable core. Advantages and disadvantages of each. Results using laboratory batches, are tabulated and plotted. (E18)

293-E. An Investigation of the Penetration of Steel into Molding Sand. Holger Pettersson. *American Foundrymen's Society,* Preprint 51-61, Apr. 1951, 20 pages.

Investigation based on immersion experiments with cylindrical sand "cores" in molten carbon steel in a high-frequency furnace. Shows how rate of penetration varies with time of immersion, metal pressure, temperature and analysis of the steel, grain size of the sand, various additions to the sand, etc. 21 ref. (E25, CI)

294-E. Die Casting Die Design. Part IV. (Continued.) H. K. Barton and James L. Erickson. *Magazine of Tooling and Production,* v. 17, May 1951, p. 52, 54, 56, 58, 100-101, 104.

Runner systems for multiple cavity dies and dies for cold-chamber machines; dies for center-shot, warm-chamber type machines; runner-systems designs; feed design; location of the feed; and gate proper. (E13)

295-E. The Production of Spun Cast Iron Pipes at Australian Iron and Steel Limited, Port Kembla, N.S.W. W. J. Ayre. *Australasian Engineer,* v. 44, Feb. 1951, p. 59-63.

Centrifugal casting process and equipment. (E14, CI)

296-E. Intricate Castings From a Durable Loam Mould. J. Currie. *Foundry Trade Journal,* v. 90, Apr. 12, 1951, p. 383-388; Apr. 19, 1951, p. 419-425.

Equipment and technique used in production of an evaporator-body casting. Durable molds are those which may be used over and over again with minor repairs and patching. (E19, CI)

297-E. Manufacture of Ingot Moulds for an Indian Steelworks. V. M. McGowan. *Foundry Trade Journal,* v. 90, Apr. 19, 1951, p. 411-416.

The author, without previous personal experience with ingot-mold manufacture, was faced with the necessity for instituting a system for their quantity production in a large jobbing foundry in India. Method by which the job was tackled and layout and equipment developed. (E11, T5, CI)

298-E. Some Curious Wasters. *Iron and Steel,* v. 24, May 1951, p. 168.

Means of discovering causes of faulty castings where the trouble is difficult to track down. (E general)

299-E. The Control of Porosity and Shrinkage Voids; Sound Die-Castings. E. N. Field. *Metal Industry,* v. 78, Apr. 27, 1951, p. 323-326.

Recommended procedures. (E13)

300-E. The Effect of Gray Iron on Grain Size and Strength Properties of Mg Alloys. (In German.) Walter Mannchen. *Zeitschrift für Metallkunde,* v. 41, Nov. 1950, p. 391-393.

Addition of gray iron to the melt has a grain-refining effect on Mg-Al alloys, provided certain conditions are observed. Pure irons have the same effect, but to a much lesser extent. Various methods of refining Mg-Al melts are compared. (E25, Q23, Mg)

301-E. Inclusions Consisting of Different Heavy-Metal Aluminides. (In German.) Franz Eberhard Wittig. *Zeitschrift für Metallkunde,* v. 41, Nov. 1950, p. 394-395.

Methods of counteracting the undesirable effect of these inclusions in Al alloys. Photomicrographs illustrate inclusions resulting from addition of 2% Fe, 1.5% Co, 1% Ni, 2% Fe + 2% Mg, 1.5% Co + 2% Mg, and 1% Ni + 2% Mg. Use of Mg in the last three cases largely minimizes inclusion formation when melting scrap containing the heavy metals. (E25, M29, Al)

302-E. Chill-Mold Casting of Brass. III. (In Dutch.) T. Van Der Klis. *Metalen,* v. 6, Mar. 31, 1951, p. 86-92.

Successful and unsuccessful methods of chill-mold casting, special attention being given to van Piel and Adey's patent, in which, during pouring, the chill mold is moved from a nearly vertical to a horizontal position. (E16, Cu)

303-E. Metal Penetration in Castings. X. Penetration in Special Steel Castings. (In Japanese.) Jiro Kashima. *Journal of the Casting Institute of Japan,* v. 22, no. 12, 1950, p. 1-5.

See abstract of English version from *Japan Science Review,* item 32-E, 1951. (E18, ST)

304-E. Relationship of CO_2 Content of Effluent Gases to Depth of the Coke Bed in the Cupola. (In Japanese.) Kiyoshi Ishikawa and Yasuo Murakami. *Journal of the Casting Institute of Japan,* v. 22, no. 12, 1950, p. 5-11. (E10, CI)

305-E. "Combination" Castings Made by Casting Fe and Bronze Around Al Bars. (In Japanese.) Seizo Yabuuchi. *Journal of the Casting Institute of Japan,* v. 22, no. 12, 1950, p. 12-15.

The castings were made and their hardness, structure, and machinability determined. Some melting and diffusion takes place. (E16, G17, M27, Q29, Fe, Cu, Al)

306-E. Centrifugally Cast Bronze-Back Bearings for Heavy-Duty Operation. L. N. Tichvinsky. *Transactions of the American Society of Mechanical Engineers,* v. 73, May 1951, p. 391-398.

Performance and salient points of manufacture of centrifugally cast bronze-backed bearings. Sand-cast and centrifugally cast bronzes are compared; advantages of the latter. Methods of rational casting of bearing-back-bronze materials and steps for improvement of their physical properties. (E14, Q general, Cu, SG-c)

307-E. Suffolk Iron Foundry. A. R. Parkes. *Foundry Trade Journal,* v. 90, May 3, 1951, p. 463-472.

Layout, equipment, and procedures of British foundry. (E11, CI)

308-E. Investment Castings Coming Up. *Product Engineering,* v. 22, May 1951, p. 126-127.

New developments, specifically in the frozen-mercury process and plaster casting. (E15)

309-E. Larger Die-Cast Parts. *Product Engineering,* v. 22, May 1951, p. 130.

Examples of trend in die castings resulting from advanced techniques and improved machines. (E13, Al, Mg)

310-E. Investment Casting Conserves Critical Materials. Rawson L. Wood and Davidlee von Ludwig. *Steel,* v. 128, May 14, 1951, p. 80-82.

By transforming metal into finished parts with a minimum of conversion waste, investment casting can stretch the available supply of strategic materials. Typical parts are illustrated. (E15)

311-E. Scrap Down, Quality Up, Through Statistical Control Systems. Harold H. Johnson. *Steel,* v. 128, May 21, 1951, p. 76-79, 98, 100, 103.

Use in production of steel castings. Control of production rate, correction of core troubles; psychology in work, historical trends, and use of trained specialists. (E general, S12, CI)

312-E. Accumulator Plate Manufacture. *Metal Industry,* v. 78, May 4, 1951, p. 364-365.

Use of Pb as the principal component of the battery. The material is cast, rolled, and perforated. (E12, F23, G2, Pb)

313-E. Processing and Salvaging Used Molding Sand, Especially for Steel Castings. (In German.) K. Roesch. *Giesserei,* v. 38 (new ser., v. 4), Apr. 5, 1951, p. 145-149.

Chemical and physical changes of molding sand as the result of high heat and contact with metal. Shows that a large proportion of used molding sand can be successfully reclaimed. (E18, CI)

314-E. Use of Lignite for Melting Pig Iron. (In German.) Nils Sjögren. *Stahl und Eisen,* v. 71, Apr. 12, 1951, p. 388-391.

Experiments proved the possibility of melting pig iron with Styrian lignite in the electric low-stack furnace, also of smelting Styrian ore with Styrian lignite in the oxygen low-stack furnace. Data on composition of the charges are tabulated. (E10, D8, Fe)

315-E. Investigation on Penetration of Liquid Steel in Molding Sand. (In Swedish.) Holger Pettersson. *Jernkontorets Annaler,* v. 135, No. 1, 1951, p. 1-43.

Penetration was studied by immersing cylindrical test pieces of molding sand into liquid steel in a high frequency furnace. The influence of steel composition, temperature, and pressure and of grain size and grain-size distribution of the sand as well as mold composition, ramming density, and sintering temperature was investigated. 22 ref. (E18, E25, ST)

316-E. (Book) **Safety Manual for Die Casting. 1951.** American Die Casting Institute, 366 Madison Ave., New York 17, N. Y. $5.00.

Covers step by step the entire diecasting plant and specific safety procedures. Aimed at the small and medium-sized plant. Presented in a cloth-covered looseleaf binder. (E13)

F

PRIMARY MECHANICAL WORKING

100-F. The Production of Shells by Cold Extrusion. *Machinery,* v. 78, Apr. 5, 1951, p. 550a-550e.

Work by Mullins Mfg. Corp. in the U. S., using ordinary low-carbon steels. (F24, CN)

101-F. Rolls and Rolling. Part XXV. Angles. E. E. Brayshaw. *Blast Furnace and Steel Plant,* v. 39, Apr. 1951, p. 439-444.

Roll-pass diagrams. (F23)

102-F. Fundamentals of the Working of Metals. Part XXI. Progressive & Steady-Flow Forming. George Sachs. *Modern Industrial Press,* v. 13, Apr. 1951, p. 6, 8, 44, 46.

Definitions of progressive forming; steady-flow processes — rolling and forging; wiper forming; extrusion forging; and spinning, progressive flanging, and drop-hammer forming. (F22, F23, F24, G13)

103-F. Electric Fusion Submerged-Arc Process Welds Expanded Steel Transmission Pipe. J. H. Middleton. *Steel,* v. 128, Apr. 23, 1951, p. 80, 82, 85, 88, 91-92, 94.

Process used at the Gulfsteel Div. of Republic Steel Corp. which uses twin arcs, spaced about ¼ in. apart, one using alternating current and the other direct current. Speed of welding depends on wall thickness of the pipe being produced, and approximates 4 ft. per min. (F26, K1, ST)

104-F. The Continuous Seamless Pipe Mill. John L. Young. *Iron and Steel Engineer,* v. 28, Apr. 1951, p. 53-58; disc. p. 58-61.

New mills at National Tube Co.'s Lorain plant. (F26, ST)

105-F. Metal Drawing Lubricants for Wire, Tubing, and Sheet Steel. Walter A. Smigel and H. Grey Verner. *Iron and Steel Engineer,* v. 28, Apr. 1951, p. 97-102; disc. p. 102-106. (F1, ST)

106-F. Developments in Large Closed Die Forging. E. O. Dixon. *SAE Quarterly Transactions,* v. 5, Apr. 1951, p. 143-150.

See abstract of "Advances in Heavy Closed Die Forging; German Counter-Blow Hammer Equipment to 100,000 L.b. Unit," *Steel Processing,* item 57-F, 1951. (F22)

107-F. New Roll-Forging Process. Frank Charity. *Machine and Tool Blue Book,* v. 47, May 1951, p. 128-130, 132.

Process of using steel rolls and hydraulic pressure to convert prefabricated steel "doughnuts" into rings. Rings may range from 8 to 76 in. o.d.; lengths up to 20 in. (F22, ST)

108-F. Cold Working of Stainless Steels. J. Lomas. *Machinery Lloyd* (Overseas Edition), v. 23, Mar. 31, 1951, p. 111, 113-114.

Special precautions employed in cold rolling. (F23, SS)

109-F. Cold Rolling Copper Alloys. C. E. Davies. *Metal Industry,* v. 78, Mar. 30, 1951, p. 243-246, 251.

First part of a condensation of "The Cold Rolling of Non-Ferrous Metals in Sheet and Strip Form," *Journal of the Institute of Metals.* See item 81-F, 1951. (F23, Cu)

110-F. Rolling Aluminium and Its Alloys. C. E. Davies. *Metal Industry,* v. 78, Apr. 6, 1951, p. 262-266; disc. p. 266-268.

Condensed from a portion of "The Cold Rolling of Non-Ferrous Metals in Sheet and Strip Form," *Journal of the Institute of Metals.* See item 81-F, 1951. (F23, Al)

111-F. Improving the Quality of Drawing Dies by Controlling the Form of the Die Aperature With Modern Measuring Methods. (In German.) Werner Lueg. *Stahl und Eisen,* v. 71, Feb. 15, 1951, p. 157-167; disc., p. 167-170.

Design factors and methods for determining the internal dimensions of the wiredrawing die aperature. (F28)

112-F. Tubing to Close Tolerances. L. A. Karg. *Machinery* (American), v. 57, May 1951, p. 164-169.

Equipment and methods used in producing compression-formed seamless tubing in a variety of shapes, sizes, and materials by a special cold-reduction process—the "Rockrite" process. (F26)

113-F. Steel Quality as Affected by Track Time and Soaking Pit Practice. A. F. Mohri. *American Iron and Steel Institute,* Preprint, 1951, 14 pages.

It is believed that specification of minimums and maximums for track times, soaking-pit heating, and soaking are of assistance in controlling quality of the finished product; and keep the necessity for conditioning this product to a minimum. (F21, ST)

114-F. High Speed Rod Bakers Expedite Production at J & L Wire Mill. *Industrial Heating,* v. 18, Apr. 1951, p. 679-680, 682, 684.

Furnace equipment for processing steel-rod coils. The baking operation follows pickling, rinsing, and line dipping and precedes drawing. (F28, ST)

115-F. Forging Operations in Steam and Diesel Locomotive Practice. Part I. Diesel Forgings. R. E. W. Harrison. *Steel Processing,* v. 37, Apr. 1951, p. 169-171.

Plain-carbon and alloy steels are used. (F22, CN, AY)

116-F. The Extrusion of Soft Metals —Principles and Applications. Andrew E. Rylander. *Tool Engineer,* v. 26, May 1951, p. 53-60.

The four methods commonly used: slow pressure; direct; indirect; and impact. (F24, G5, EG-a)

117-F. For Best Forming Results Use the Right Lubricant. E. L. H. Bastian. *Steel,* v. 128, May 7, 1951, p. 116-119, 130, 133.

Selection of lubricants for press drawing, hot and cold forging, and hot and cold extruding. Practical tips for selecting lubricants to facilitate forming of carbon and low-alloy steels, stainless, Cu and brass, Mg, and Al. (F1, G21)

118-F. Extruded Steel Propeller Blades Save Materials—Manpower—Machining—Tools. *Magazine of Tooling and Production,* v. 17, May 1951, p. 70, 72, 153.

New mass-production method of hot extruding one-piece, hollow-steel propeller blades for high-speed combat and commercial aircraft. (F24, ST)

119-F. The Reduction of Residual Stresses in Cold-Drawn Bars. H. Bühler and E. H. Schulz. *Engineers' Digest,* v. 12, Apr. 1951, p. 123-125. (Translated and condensed.)

Previously abstracted from *Stahl und Eisen.* See item 21-F, 1951. (F27, CN)

120-F. Plant Difficulties in Seamless Tube Manufacture. F. Maslyn. *Australasian Engineer,* v. 44, Mar. 7, 1951, p. 54-60.

Fractures, galling, and mill defects. (F26, ST)

121-F. Lubricants in Cold Working. S. F. Chisholm. *Metal Industry,* v. 78, Apr. 13, 1951, p. 283-285; disc., p. 285-286.

Previously abstracted under similar title from *Journal of the Institute of Metals.* See item 80-F, 1951. (F1, G4)

122-F Patenting and Drawing Tests on Austenitic Coarse and Fine-Grained Steel Wires and the Effect of Small Contents of Carbide-Forming Alloy Additions. (In German.) Werner Papsdorf. *Archiv für das Eisenhüttenwesen,* v. 22, Mar.-Apr. 1951, p. 87-98. 27 ref. (F28, J25, ST)

123-F. Rolls and Rolling. Part XXVI. Angles. E. E. Brayshaw. *Blast Furnace and Steel Plant,* v. 39, May 1951, p. 553-560.

Additional roll-pass diagrams and descriptive material. (F23)

124-F. Big Forgings Ahead. *Product Engineering,* v. 22, May 1951, p. 120-121.

Development of larger forgings based on German work and machines. (F22)

125-F. Wisconsin Plant Operating Huge Forging Hammer. *SAE Journal,* v. 59, May 1951, p. 34-35. (Based on "Developments in Large Closed Die Forging," by E. O. Dixon.)

Previously abstracted from complete paper in *SAE Quarterly Transactions.* See item 106-F, 1951. (F22)

126-F. Cold Rolling Strip: An Appraisal of Today's Theory and Practice. (Continued.) J. D. Keller. *Steel,* v. 128, Mar. 26, 1951, p. 84, 86, 89; May 14, 1951, p. 98, 100, 103-104.

Mar. 26: reasons why an increase in rolling speeds causes a decrease in friction coefficient, and the importance of lubrication as related to coefficient of friction. May 14: conflicting factors which indicate that additional experimental information is necessary to determine compressive strength of strip. Meanwhile, tensile-test values are recommended for normal rolling of strip in conjunction with a multiplying factor not greatly in excess of unity. (F23, Q28, ST)

127-F. Cold Rolling Technique: The Application of Theory and Experiment to the Practice of Rolling; Methods of Calculating Roll Force and Torque Based on Theories of Rolling. (Continued.) Hugh Ford. *Sheet Metal Industries,* v. 28, May 1951, p. 427-434, 438.

Detailed mathematical analysis and description of various methods. (To be continued.) (F23)

G

SECONDARY MECHANICAL WORKING

160-G. Pad Your Trimming Dies With Economical Zinc. H. C. Slagle. *American Machinist,* v. 95, Apr. 16, 1951, p. 136-137.

Use of open-back presses to trim Al die castings. To keep die-construction costs down, Zn pads are cast around sample workpieces, then are installed around trimming dies to prevent the die castings from buckling when flash and runners are chopped off. (G15, T5, Al, Zn)

161-G. The Design of Special Hood for Machine Tools. James M. Taub. *U. S. Atomic Energy Commission,* AECD-3048, Aug. 20, 1948, 20 pages.

Various types of hoods used in certain shops of the Los Alamos Laboratory. The machine tools to which most the work has been devoted are Monarch lathes and Milwaukee No. 2H milling machines, which are the most difficult machines to hood. (G17)

162-G. Magnetic Sheet Separator Improves Production. *Iron Age,* v. 167, Apr. 26, 1951, p. 103-104.

Equipment for use in connection with punch-press and shearing operations. Purpose is to separate a stack of sheets by means of repelling magnetic fields, so that punch press operators can easily lift a sheet from the top of a stack and feed it into the press. (G1, ST)

163-G. Engineering Developments in Production Processes. T. E. Piper. *Western Machinery and Steel World,* v. 42, Apr. 1951, p. 70-73.

Miscellaneous new developments in aircraft fabrication, mainly forming, joining, machining, etc. (G general, K general, T24)

164-G. Machining Gas Turbine Alloys. K. J. B. Wolfe and P. Spear. *American Machinist,* v. 95, Apr. 30, 1951, p. 125, 127, 129.

Compositions and machining characteristics of various types are tabulated. Selection of tool materials and cutting fluids. (G17, AY, TS, SG-h)

165-G. Oxy-Acetylene in Steel Fabrication. Charles I. Orr. *Canadian Metals,* v. 14, Apr. 1951, p. 43-44.

Use for material preparation and local heating; edge preparation, shaping of sections, cutting and gouging, and plate straightening. (G22, F29, ST)

166-G. Research Trebles Machining Rate. *Machinery Lloyd* (Overseas Edition), v. 23, Mar. 31, 1951, p. 115, 117.

Work by the Production Engineering Research Assn. of Great Britain. (G17)

167-G. Gas-Turbine Steels; Machining Austenitic and Ferritic Alloys. Part I. Materials, Cutting Tools and Cutting Fluids. Part II. Machining Conditions for Various Processes. K. J. B. Wolfe and P. Spear. *Aircraft Production,* v. 13, Mar. 1951, p. 80-83; Apr. 1951, p. 117-120.

Problems associated with machining of heat resisting and creep resisting steels and alloys. Results of the work of the B.S.A. Group Machinability Research Laboratory on turning, milling, drilling, broaching, grinding, and examination of cutting fluids. Some information on recent work carried out in the U. S. and in Russia. 33 ref. (G17, AY, SS, SG-h)

168-G. Improving Machinability of Ductile Iron by Annealing. J. W. Kahles and R. Goldhoff. *Foundry Trade Journal,* v. 90, Apr. 5, 1951, p. 365-367.

Shows that adequate machinability and physical properties can be obtained in ductile iron without complete pearlite decomposition. Increased Si content accelerates carbon solution, while pearlite breakdown is mainly a function of Mn content. Small amounts of carbide can be tolerated if the matrix is basically ferrite. (G17, J23, N8, CI)

169-G. Glass-Lined Steel Vessels. *Industry & Welding,* v. 24, May 1951, p. 40-41, 83.

Forming and welding operations. (G general, K general, CN)

170-G. Possibilities and Limitations of the Marform Process. Henry P. Hessler, J. E. Broderick, and Fred C. Young. *Machinery* (American), v. 57, May 1951, p. 159-163.

The Marform process employs a rubber forming cushion and precisely controlled hydraulic pressure to form and draw parts of various shapes and materials. Specific information on application and economical use of the process in the manufacture of sheetmetal parts of steel and Al. (G1, Al, ST)

171-G. Stretch Brake Cuts Forming Cost 90%. *Aviation Week,* v. 54, May 7, 1951, p. 42, 44.

Simple hydraulic press attachment which speeds production runs of foil leading-edge skins, developed by Northrop Aircraft. (G9, Al)

172-G. Cutting Bars for Tubing. *Welding Engineer,* v. 36, May 1951, p. 34.

Production in a tube mill has been speeded up considerably by a mechanized set-up for flame-cutting bars to length. It cuts through 5 in. of steel in 20 sec. (G22, CN)

173-G. Fabricating Stainless Steel Sinks at Pride Manufacturing Co. John C. McComb. *Steel Processing,* v. 37, Apr. 1951, p. 172-174.

Blanking, shearing, forming, Heliarc welding, soldering, and mechanical polishing. (G1, K1, K7, L10, SS)

174-G. Shot-Peening Springs. *Mainspring,* v. 13, Apr. 1951, p. 1-4.

Development of cast alloy shot, cut wire shot, and heat treated cast steel shot. Results of work using different types and sizes to peen oil-tempered, carbon steel valve-spring wire. (G23, CN)

175-G. Electric Strain Gage Tool Dynamometers. E. G. Loewen, E. R. Marshall, and M. C. Shaw. *Proceedings of the Society for Experimental Stress Analysis,* v. 8, No. 2, 1951, p. 1-16.

Dynamometers for use in measuring the forces exerted upon metal-cutting tools utilizing electric strain gages. Machining operations involved include planing, drilling, grinding, and turning. The bridge circuits used and mechanical aspects of each unit. Design details of load-measuring elements. (G17)

176-G. Aluminium Beer Barrels. *Metal Industry,* v. 78, Apr. 27, 1951, p. 348-349.

Production by deep drawing. Annealing, seam welding, and inspection procedures. (G4, Al)

177-G. Carbide High-Velocity Turning. Leif Fersing. *Transactions of the American Society of Mechanical Engineers,* v. 73, May 1951, p. 359-374.

Measurements of chip temperature, loads on tools, effect of chip breakers, and the effect of turning speeds on the quality of finished surfaces. Illustrates tools cutting at surface speeds up to 2400 ft. per min. Parts now being machined in the "high-velocity turning range" in production. Most tool-load data were obtained from turning cuts on two types of normalized steel. SAE C1118, cold-rolled, and SAE 8747, hot-rolled. (G17, CN, AY)

178-G. Stress Distribution in the Continuous Chip—A Solution of the Paradox of Chip Curl. E. K. Henriksen. *Transactions of the American Society of Mechanical Engineers,* v. 73, May 1951, p. 461-465; disc., p. 465-466.

The chip passes along the tool face for a certain distance before it leaves the tool and then curls through space. Assumes that a sudden drop in pressure occurs at the point of ultimate contact, which combines with a single force at this point. Physical origin of this system of forces is explained by surface roughness of the tool, which leads to an explanation of the sharp boundary line for the area of wear on the tool face. Distribution of pressure between chip and tool follows an exponential law. Methods of stress analysis which should be useful in further investigations. (G17)

179-G. Superior Machinability of MX Explained. F. W. Boulger, H. A. Moorhead, and T. M. Garvey. *Iron Age,* v. 167, May 17, 1951, p. 90-95.

It was found that a slight difference in Si content has more effect on machinability than either C or P over the normal ranges found in bessemer steels. Data to explain variations in machining among free-cutting steels of the same specification. (G17, CN, SG-k)

180-G. More Production and Better Quality by Cold Extrusion. *Product Engineering,* v. 22, May 1951, p. 118-119.

New developments specifically in extrusion of steel and Al. (G5, ST, Al)

181-G. Flexible Dies to Improve Deep Drawing Techniques. *Product Engineering,* v. 22, May 1951, p. 131.

Marform and Hydroform developments. (G1)

182-G. Finishing Home Freezer Cabinets. Arthur Q. Smith. *Products Finishing,* v. 15, May 1951, p. 16-24.

Equipment and procedures. Stamping and forming of sheet steel, cleaning, phosphatizing, spray finishing, assembly, and testing. (G general, L general, ST)

183-G. Stress Analysis of Reverse Redrawing of Cylindrical Shells. S. Y. Young. *Sheet Metal Industries,* v. 28, May 1951, p. 453-458.

Details of theoretical analysis and experimental investigation. Results are compared and typical calculations presented. (G4, Q25)

184-G. Bumper Guards Deep Drawn 220 per Hour. *Steel,* v. 128, May 14, 1951, p. 88.

Picture story of operations at Ueber Tool & Mfg. Co., Detroit. (G4, ST)

185-G. Cold Forming of Low Carbon Steel. Part II. Lester F. Spencer. *Steel Processing,* v. 37, Apr. 1951, p. 184-187.

Evaluation for drawability and the drawing operation itself. Concludes section on aging difficulties. (To be continued.) (G4, CN)

186-G. Effects of Light Peening on the Yielding of Steel. Howard L. Harrison and Blake D. Mills, Jr. *Welding Journal,* v. 30, May 1951, p. 251s-253s.

Results of exploratory investigation of mild steel strips indicate a number of interesting features of the behavior of constant-stress members under light transverse hammering. Even when the steady stress was less than half the yield point, a few hundred light blows of a flat-faced hammer caused quite appreciable plastic elongation. (G23, Q23, ST)

187-G. Pressure Vessel Design Effects of Pressurizing. R. E. Cecil. *Welding Journal,* v. 30, May 1951, p. 424-434.

Testing thin-walled pressure vessels at a test pressure in excess of the working pressure reshapes the heads and areas around the openings and acts as a stress relieving operation. Fundamental and empirical considerations and evaluation of test requirements. Accuracy of the jacket test for heads only was determined. (G23, Q25)

188-G. Seat-Manufacture: Design and Production of Aircraft Passenger-Chairs. Part III. Design Variations; Single-Passenger Chair Manufacture; Machine Pipe-Bending. L. G. Burnard. *Aircraft Production,* v. 13, May 1951, p. 147-153.

Includes information on press bending, torch welding, assembly, upholstering, etc. (G6, K2, T24)

H

POWDER METALLURGY

22-H. Graphical Representation of Properties of Sintered Materials by Means of a General System of Coordinates Related to the Fully Dense Material. Gustav F. Hüttig. *Powder Metallurgy Bulletin,* v. 6, Apr. 1951, p. 7-12.

Density, electric conductivity, elasticity, magnetic saturation, and residual induction of Cu, Fe, Mo, Ni, and W. Includes tensile strength data for Ni.
(H11, Cu, Fe, Mo, Ni, W)

23-H. The Effect of the Pore Volume of Sintered Materials on the Magnetic Characteristics. K. Torkar. *Powder Metallurgy Bulletin,* v. 6, Apr. 1951, p. 13-17.

For pure iron. (H11, Fe)

24-H. Production of Tungsten Alloys of High Density by the Infiltration Process. R. Palme. *Powder Metallurgy Bulletin,* v. 6, Apr. 1951, p. 32-34.

A new method of producing tungsten-heavy-metal alloys by infiltration of W skeletons with a eutectic W-Ni alloy. Composite alloys of density 17.5-18.1 g. per cc. and good machinability can be obtained.
(H16, W)

25-H. Tungsten-Reinforced Superalloys. Claus G. Goetzel. *Powder Metallurgy Bulletin,* v. 6, Apr. 1951, p. 35-40.

Infiltration of skeletons of W and W-Cr alloys with the Ni-base alloy Nichrome-V and Hastelloy-C and some Co-base alloys. Surface-impregnation treatments were applied to some of the resultant composite bodies. (H16, W, Ni)

26-H. The Formation of Metal From Its Compounds During Sintering. Henry H. Hausner. *Powder Metallurgy Bulletin,* v. 6, Apr. 1951, p. 41-43.

Advantages of using Zr hydride powder for powder metallurgy sintering processes, over the use of Zr powder. (H15, Zr)

27-H. An Investigation of the Effect of Final Density of Copper Infiltrated Iron on Physical Properties. George Stern. *Powder Metallurgy Bulletin,* v. 6, Apr. 1951, p. 57-62.

Study to determine the effect of complete and incomplete infiltration in bodies having various uniform Fe-skeleton densities. (H16, H11, Fe)

28-H. ZrC·Cb Cermals. *Metal Progress,* v. 59, Apr. 1951, p. 548, 550. (Condensed from "Sintering Mechanism Between Zirconium Carbide and Columbium", H. J. Hamjian and W. G. Lidman.

Previously abstracted from *National Advisory Committee for Aeronautics,* Technical Note 2198. See item 88-H, 1950. (H15, C-n, Zr, Cb)

29-H. Unconventional Methods in Powder Metallurgy. *Metal Progress,* v. 59, Apr. 1951, p. 550, 552. (Translated and condensed from "Some New Methods of Powder Metallurgy", G. Wassermann.)

Previously abstracted from *Metallforschung.* See item 5a-47, 1947. (H14)

30-H. Rolling of Powder Metals. *Metal Progress,* v. 59, Apr. 1951, p. 586 (Translated and condensed from "Rolling of Strips From Iron Powder", Gerhard Naeser and Franz Zirm.

Previously abstracted from *Stahl und Eisen.* See items 104-H, 1950, and 11-H, 1951. (H14, Fe)

31-H. Pickle Liquor May Yield Cheaper Fe Powder. *Iron Age,* v. 167, May 3, 1951, p. 112.

Process involves extraction of Fe powder from waste pickle liquor and scrap Al. At present, indications are that the price may run substantially less than imported sponge iron. (H10, A8, Fe)

32-H. Fundamental Problems of Sintering Processes. W. E. Kingston and G. F. Huettig. "The Physics of Powder Metallurgy", Ed. 1 (McGraw-Hill, New York), 1951, p. 1-25; disc. p. 25-26.

Thermodynamics and thermochemistry; methods of atom movement or transport; kinetics of sintering; present status of theory and suggestions for future effort. 26 ref. (H15, P12)

33-H. Surface Tension as a Motivation for Sintering. Conyers Herring. "The Physics of Powder Metallurgy", Ed. 1 (McGraw-Hill, New York), 1951, p. 143-178; disc. p. 178-179.

Chemical potentials for a pure substance; relation of the chemical potentials to diffusion; relation of the chemical potentials to vapor pressure and evaporation; chemical potentials beneath a smoothly curved surface; chemical potentials beneath a faceted surface; interfacial equilibria at grain boundaries; chemical potentials at grain boundaries; and relation of surface stresses to dislocations and plastic flow. 17 ref. (H15, P10, Q24)

34-H. Relationship Between Properties and Structure of Sintered Material Made Up of a Single Atom Type. G. F. Huettig, K. Adlassnig, and O. Foglar. "The Physics of Powder Metallurgy", Ed. 1 (McGraw-Hill, New York), 1951, p. 180-188.

Theoretical discussion followed by an outline of some experimental work on Cu, Mo, and W powders. These were sintered and their density, electrical conductivity, sonic propagation velocity, and modulus of elasticity determined.
(H15, M27, P10, P15, Q21, Cu, Mo, W)

35-H. Shrinkage of Synthetic Pores in Copper. A. W. Postlethwaite. "The Physics of Powder Metallurgy", Ed. 1 (McGraw-Hill, New York), 1951, p. 189-200; disc. p. 200-201.

States of aggregation through which powdered-metal compacts pass in their progress toward equilibrium; and nature of the changes in cylindrical pores in Cu. Experiments in which cylindrical pores are formed within relatively large masses of pure Cu, and changes in radius and volume of these pores are measured after long periods of heating *in vacuo* at elevated temperatures. Procedure and results obtained. 14 ref. (H15, Cu)

36-H. Theoretical Aspects of Sintering of Carbides. Richard Kieffer. "The Physics of Powder Metallurgy", Ed. 1 (McGraw-Hill, New York), 1951, p. 278-291; disc. p. 292-294.

Correlates and discusses the literature. Effects of sintering conditions and compositions on physical and mechanical properties. Includes phase diagrams. 10 ref.
(H15, M24, C-n)

37-H. Sintering of Cu-Au Alloys. Pol Duwez and Charles B. Jordon. "The Physics of Powder Metallurgy", Ed. 1 (McGraw-Hill, New York), 1951, p. 230-236; disc. p. 236-237.

When a compact consisting of a mixture of two metal powders is sintered, the ultimate formation of a homogeneous alloy is the result of a diffusion process. Excluding the possibility of formation of a liquid phase during sintering, two cases may be considered: the two metals form a continuous series of solid solutions at all temperatures, and the two metals are only partially soluble and form intermediate phases or definite compounds. Shows that Cu-Au alloys belong to the second class. (H15, N1, Cu, Au)

38-H. Sintering With a Liquid Phase. F. V. Lenel. "The Physics of Powder Metallurgy", Ed. 1 (McGraw-Hill, New York), 1951, p. 238-253; disc. p. 253-255.

As a typical example, compacts of 80% Fe + 20% Cu were studied at a sintering temperature of 1120° C., except for a few tests at 1200° C. Compacts made from different particle-size ranges and different grades of Fe powder were sintered for increasing times, and changes in density and microstructure being measured. (H15, Fe)

39-H. Principles and Present Status of Hot Pressing. Claus G. Goetzel. "The Physics of Powder Metallurgy", Ed. 1 (McGraw-Hill, New York), 1951, p. 256-276; disc. p. 276-277.

Hot pressing has achieved complete densification of parts from many metals: Cu, Au, brasses, bronzes, Fe, steels, and cemented carbides. Tabular and graphical data and photomicrographs. Unsolved problems. 11 ref. (H14)

40-H. Experimental Production of Pure Titanium Carbide Powder by Means of Carbonizing Gases. Volmer Fattinger. "The Physics of Powder Metallurgy", Ed. 1 (McGraw-Hill, New York), 1951, p. 295-301; disc. p. 301-302.

Five different methods, particularly one developed in which H_2 and $CHCl_3$ pass through a carbon filter and then react with TiO_2 pellets to produce a carbide saturated with carbon. (H10, Ti, C-n)

41-H. Nature of Metal Powders Prepared by Reduction of Oxides. Bernard Kopelman. "The Physics of Powder Metallurgy", Ed. 1 (McGraw-Hill, New York), 1951, p. 303-309; disc. p. 309-310.

Work confined essentially to tungsten powder and its oxides.
(H10, W)

42-H. Particle-Size Distribution of Tungsten and Molybdenum Powders. A. D. Power and I. M. Kakascik. "The Physics of Powder Metallurgy", Ed. 1 (McGraw-Hill, New York), 1951, p. 311-318. disc. p. 318-319.

In connection with the manufacture of electron tubes, cathode heater wire is made by alloying powdered W and Mo. Efforts made to find methods of classifying the powders to distinguish those satisfactory for wire making. Preliminary measurements made from elctron micrographs to determine size distribution indicated that this might be useful. Methods devised, work done, and results obtained in determining and using particle-size distribution. (H11, W, Mo)

43-H. Electrical Properties as Indications of the Degree of Sintering. Henry H. Hausner and John H. Dedrick. "The Physics of Powder Metallurgy", Ed. 1 (McGraw-Hill. New York), 1951, p. 320-340; disc. p. 341-343.

Sintered materials as electrical networks; electrical resistivity-density correlation as a function of degree of sintering; correlation between electrical resistivity and pressure in the green compact; and temperature coefficient of resistance of sintered materials. 17 ref. (H15, P15)

44-H. Fundamentals of Pressing of Metal Powders. R. P. Sellig. "The Physics of Powder Metallurgy", Ed. 1 (McGraw-Hill, New York), 1951, p. 344-370; disc. p. 370-371.

Behavior of metal powders under pressure and properties of the compact after ejection. Published data on the effect of certain conditions, and original experiments carried out where new evidence was needed for the understanding of pressing phenomena. 18 ref. (H14)

45-H. Alloy Powder Products From Fully Alloyed Powders. G. J. Comstock and J. D. Shaw. "The Physics of Powder Metallurgy", Ed. 1 (McGraw-Hill, New York), 1951, p. 372-386; disc. p. 386-387.

Development of methods for production of ferrous and nonferrous alloys in powder form, and production of sintered parts from them. (H10)

46-H. Mechanisms of the Sintering of Metal Powders. (In German.) W. Dawihl. *Schweizer Archiv für angewandte Wissenschaft und Technik,* v. 17, Mar. 1951, p. 91-96.

Critical illustrated review of studies of powder-metallurgy reactions under different temperatures and pressures indicates that, under certain conditions, sintering of two metal surfaces results in an intermediate layer that is stronger than the metals themselves. Formation of this layer is promoted and accelerated by certain foreign substances and its effect increases as grain sizes decrease, indicating the possibility of producing sintered parts that are stronger than cast ones. 22 ref. (H15)

47-H. Powdered Metals May Answer High Temperature Problem. *Product Engineering,* v. 22, May 1951, p. 123.

With perfection of a technique for infiltrating Fe powder with Cu-alloy, it is now possible to mass-produce jet-engine blades having a yield strength of 90,000 psi. These pressings are able to withstand 3-4 times as much vibration as type 403 stainless and 4 times as much as carbon-steel blades. (H16)

48-H. Production of Metal Powders. (In German.) R. E. Fischer. *Zeitschrift für Erzbergbau und Metallhüttenwesen,* v. 4, Apr. 1951, p. 159-161.

Various methods of pulverizing metals for use in powder metallurgy. (H10)

49-H. (Book) **The Physics of Powder Metallurgy.** Ed. 1. Walter E. Kingston, editor. 404 pages. 1951. McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18. $8.50.

Consists of 22 papers and accompanying discussion presented at Bayside, L. I., New York, Aug. 24-26, 1949. Individual papers are abstracted separately. (H general, N general)

J

HEAT TREATMENT

119-J. Wire Rope Manufacture. Arthur Q. Smith. *Industrial Gas,* v. 29, Apr. 1951, p. 3-6.

Gas-fired heat treating equipment used by Union Wire Rope Co., Kansas City, Mo. (J general, ST)

120-J. Good Carburizing Practice. (Concluded.) **XI. How to Control Carburizing Equipment. XII. How to Measure Cast Depth.** T. A. Frischman. *American Machinist,* v. 95, Apr. 2, 1951, p. 92-95; Apr. 16, 1951, p. 140-142.

Poor stress distribution within the case and decarburization are among faults to be overcome. Accepted methods for determining hardenability of steel and devices for controlling dew point of gases. Final installment: details of various methods and applications for case-depth measurement. (J28, ST)

121-J. Embrittling Effect of Steam on Stainless at Elevated Temperatures. Carl A. Zapffe and F. E. Landgraf. *Steel,* v. 128, Apr. 30, 1951, p. 54-57, 81-82.

Hardened steels which endure a full bend after quenching from a dry atmosphere fail at a relatively low bend angle if steam is admitted to the heat treating furnace. This is specifically true of types 410 or 403, designed for service in steam turbines. The effect is extremely rapid. Causes and cures of this H_2 sensitivity. (J26, Q23, SS)

122-J. Continuous Annealing Arousing Industry Interest. W. R. Weir. *Steel,* v. 128, Apr. 30, 1951, p. 68, 70, 72, 74, 84.

Process in which a single strand of steel is annealed and cooled in less than 2 min.—although in use for at least 10 years—has just recently received serious consideration from cold rolled steel producers. (J23, ST)

123-J. Some Aspects of Annealing Atmospheres for Tin Plate Strip. J. R. Trimble and J. E. Hill. *Iron and Steel Engineer,* v. 28, Apr. 1951, p. 70-73; disc. p. 73.

Shows that annealing atmospheres may have a very important effect on corrosion resistance and life of tinplate coatings. (J23, Sn, CN)

124-J. Engineering Properties of Iron Castings Can be Improved by Heat Treatment. C. E. Herington. *Metal Treating,* v. 2, Jan.-Feb. 1951, p. 6-7; Mar.-Apr. 1951, p. 6-9.

(Based on articles of same title in *Materials & Methods.* See item 5-J, 1951. (J26, Q general, CI)

125-J. Suggested New Approach to the Mechanism and Effects of Solution Treatment & Aging on Metal-Alloy Wires & Strip. C. P. Bernhoeft. *Wire Industry,* v. 18, Apr. 1951, p. 371-374, 377.

A new theory mainly based on physical chemistry, and applicable to other products besides alloy strip and wire. (J27)

126-J. Nitriding; Developments and Applications for Steel. R. W. Allott. *Iron and Steel,* v. 24, Apr. 1951, p. 145-148.

An illustrated review. (J28, ST)

127-J. Local Stress-Relief Annealing. (In German.) R. Schnabbe, R. Mailänder, and H. J. Wiester. *Brennstoff-Wärme-Kraft,* v. 3, Mar. 1951, p. 79-85.

Experiments with a large welded cylindrical vessel show that local stress-relief annealing is less effective than annealing the entire drum, but that local annealing is satisfactory for most ordinary purposes, residual stresses being relatively small. Method of experimentation and data. (J23, ST)

128-J. An Investigation on Boron-Treated Steels. I. On the Hardenability of Boron-Treated Medium-Carbon Steels, Especially the Effect of Nitrogen Content in Steels. (In English.) Yunoshin Imai and Hikotaro Imai. *Science Reports of the Research Institutes, Tohoku University,* ser. A, v. 2, Apr. 1950, p. 260-269.

Maximum hardenability was obtained by addition of about 0.003% B, being decreased sharply upon further increase of boron. Effects of N_2 and of deoxidation or denitriding by Al or TI, prior to B addition, were determined. 11 ref. (J26, B, CN)

129-J. Oldsmobile Axle Shafts Are Heat Treated Automatically. *Industrial Heating,* v. 18, Apr. 1951, p. 598-602, 604, 606, 748, 750, 752.

Equipment and procedures. Material is SAE 1330 steel. (J general, T21, CN)

130-J. Heat Treating of Aircraft Components Economized by Methodical Purchasing of Pyrometer Supplies. Harry James. *Industrial Heating,* v. 18, Apr. 1951, p. 630, 632, 634, 636.

Procedures and equipment. Temperature measurement and control. Annealing steel and brass and brazing Cu and Ag. (J23, K8, S16, ST, Cu, Ag)

131-J. Motorcycle Parts Annealed at Harley-Davidson With Double-End Oven. *Modern Machine Shop,* v. 23, May 1951, p. 220. (J23, ST)

132-J. Age Hardenable High-Nickel Alloys. W. A. Mudge. *Metal Progress,* v. 59, Apr. 1951, p. 529-536.

Details of aging treatments, and of mechanical and physical properties of three monels, Duranickel, Permanickel, and Inconel X. (J27, Q general, P general, Ni)

133-J. Heat Treatment of Age Hardenable High-Nickel Alloys. *Metal Progress,* v. 59, Apr. 1951, p. 528B.

A data sheet. (J27, Ni)

134-J. Induction Heater Hardens 15 Different Parts. *Iron Age,* v. 167, May 3, 1951, p. 110.

Fifteen different parts are currently being processed with a single induction-heating generator at Oliver Corp., Charles City, Iowa, at a saving of nearly half of previous heat treating costs. (J2)

135-J. An Investigation on Boron-Treated Medium-Carbon Steels. Yunoshim Imai and Hikotaro Imai. *Engineers' Digest,* v. 12, Apr. 1951, p. 115-117. (Condensed.)

Previously abstracted from *Science Reports of the Research Institutes, Tohoku University.* See item 128-J, 1951. (J26, B, CN)

136-J. The Relative Effects of Chromium and Silicon Contents on Rate of Anneal of Black-Heart Malleable Iron. Part I. First Stage Annealing. J. E. Rehder. *American Foundrymen's Society,* Preprint 51-51, Apr. 1951, 6 pages.

Determination in the first, or primary carbide decomposition stage, shows that Cr neutralizes the graphitizing effect of 4-5 times its weight of Si. The necessary changes in annealing practice can be determined from charts. Includes photomicrographs. (J23, N8, CI)

137-J. Malleable Cast Irons—Annealing Furnaces and Atmosphere. O. E. Cullen and R. J. Light. *American Foundrymen's Society,* Preprint 51-62, Apr. 1951, 6 pages.

Furnace designs and atmosphere control for blackheart malleable cast iron. History of the process. (J23, CI)

138-J. Armour Plate—Continuous Treatment of Lighter Grades. Horace Drever. *Iron and Steel,* v. 24, May 1951, p. 189-192.

Continuous heat treatment of armour plate under 6 in. thick. Principal operations are hardening, quenching and tempering. (J26, J29, CN)

139-J. Heat Treatment of Light-Alloy Equipment and Material. (In French.) Paul Penel. *Revue de l'Aluminium,* v. 28, Jan. 1951, p. 31-38.

Equipment and procedures for the above for both salt-bath and atmospheric heat treatment. Includes details of calculations. (To be continued.) (J2, AY, Mg)

140-J. Thermal Treatment of Light Alloys. Practical Suggestions. (In French.) Paul Penel. *Revue de l'Aluminium,* v. 28, Mar. 1951, p. 105-115.

Concludes series. (J general, Al)

141-J. Physics of Metals. Homogenization and Dehomogenization in Steels. (In French.) L. Colombier. *Métaux & Corrosion,* v. 25, Dec. 1950, p. 295-307.

Discussed from the metallurgical

point of view. Experimental results for several different types of steel. Includes phase diagrams and photomicrographs. (J21, ST)

142-J. Flame Hardening and Tempering of Steel. (In German.) Hans Bühler and Hans Wilhelm Grönegress. *Stahl und Eisen,* v. 71, Mar. 29, 1951, p. 343-347.

Test results on nine steels show that proper methods and equipment permit hardening and tempering of steel bars up to 80 mm. in diam. without furnaces. Advantages over furnace hardening. 13 ref. (J2, J29, ST)

143-J. Accuracy of Calculation of Carbon Penetration in Large-Scale Carburization of Steels. (In German.) Adolf Slattenschek. *Archiv für das Eisenhüttenwessen,* v. 22, Mar.-Apr. 1951, p. 117-130.

Validity of an equation for the above was investigated on the basis of H. Schrader and R. Monfang's data. Anomalous deviations from the theoretical results were found to be caused by overcarburization or decarburization. Careful experiments produced results which agreed closely with computed ones. 21 ref. (J28, ST)

144-J. The Bright-Annealing of Electrolytic Copper Wire and Strip. (In Dutch.) M. T. Den Haan and J. J. M. Roos. *Smit Mededelingen,* v. 6, Jan.-Mar. 1951, p. 7-12.

Procedures and equipment of Dutch plant. (J23, Cu)

145-J. Heat Treatment of Boiler Steels. *American Machinist,* v. 95, May 14, 1951, p. 173.

A data sheet. (J general, T25, ST)

146-J. Machine for Hardening Rail Ends Developed on the Southern. *Railway Engineering and Maintenance,* v. 47, May 1951, p. 453-455.

Specialized flame hardening equipment and its development. Results obtained and capacity of the machine. (J2, CN)

147-J. Annealing and Carbon Restoration Handled in One Operation. *Steel,* v. 128, May 14, 1951, p. 97.

In one continuous furnace operation, bars are annealed and carbon restored to their surface at Union Drawn Steel Div., Republic Steel Corp., Massillon, Ohio. This furnace is regarded as one of the latest developments in the steel industry. (J23, ST)

148-J. The Surface Hardening of Steel. Part IV. Pack Carburizing Practice. G. T. Colegate. *Metal Treatment and Drop Forging,* v. 18, Apr. 1951, p. 163-170.

Materials and designs available for containers and factors which promote their deterioration. The advantages of pack carburizing and methods of packing components; furnace-heating methods and recommendations for efficient furnace utilization. (To be continued.) (J28, ST)

149-J. Production and Metallurgical Characteristics of Mining Hollow Drill Steel in Australia. Daniel Clark. *Metallurgia,* v. 43, Apr. 1951, p. 161-166.

Heat treatment and types of failure encountered in service. Importance of forging operation; hardening of bits and shanks; fatigue failures; service failures; proposed testing station. (J26, F22, S21, TS)

150-J. Principles of New Heat Treating Processes for Steels and a New Martensite Diagram. (In German.) Roland Mitsche. *Berg-und Hüttenmännische Monatshefte,* v. 96, Feb. 1951, p. 25-28.

New methods of transforming steels and a new concept of the martensite stage. Includes time-temperature-transformation diagrams. (J26, N8, ST)

K JOINING

265-K. Nitro Sphere Design Solves Unique Fabrication Problem. John A. Toland. *Western Metals,* v. 9, Apr. 1951, p. 30-31.

Arc-weld fabrication of stainless steel spherical tank for liquid nitrogen storage. (K1, T26, SS)

266-K. Welding at the St. George. Jack Medoff. *Welding Engineer,* v. 36, Apr. 1951, p. 17-20.

Maintenance welding at Hotel St. George, Brooklyn. Principal materials are plain carbon and stainless steel, and monel. (K general, CN, SS, T26, Ni)

267-K. Spot Brazing Chair Frames. *Welding Engineer,* v. 36, Apr. 1951, p. 21.

Arnolt Corp. ships Cr-plated dinette and card-table chairs knocked down. Local distributors use spot brazing for assembly. (K8, CN)

268-K. In Italy It's Vierendeel. A. Bozzarelli. *Welding Engineer,* v. 36, Apr. 1951, p. 22-25.

Vierendeel truss design is said to offer other advantages such as better corrosion resistance and lowered maintenance. Weld fabrication and erection. (K general, T26, CN)

269-K. How We Repair Steel Castings. Alfred E. Blake, Jr. *Welding Engineer,* v. 36, Apr. 1951, p. 26-29, 33.

Use of semi-automatic, submerged-arc welding for repair of high-temperature, high-pressure steel castings produced at the Everett steel foundry of General Electric Co. (K1, CI, SG-h)

270-K. Stainless-Steel Towers for Scottish Oil Refinery. E. N. Zimmerman. *Welding Engineer,* v. 36, Apr. 1951, p. 34-35, 39.

Arc-weld fabrication by Chicago Bridge & Iron Co. at its Birmingham, Ala., plant. (K1, T26, SS)

271-K. Even on One-Time Jobs Mechanization Cuts Costs. H. Jackson. *Welding Engineer,* v. 36, Apr. 1951, p. 36-39.

Use of grit blasting to clean plate edges, vacuum recovery and separation of flux, and automatic or semi-automatic submerged-arc welding instead of manual welding at Thompson Pipe and Steel Co., Denver. (K1, ST)

272-K. Stainless Welded Without Columbium. Richard K. Lee. *Welding Engineer,* v. 36, Apr. 1951, p. 40-42.

See abstract under similar title from *Machinery* (American), item 185-K, 1951. (K1, SS)

273-K. Studies of Ceramic Fluxes for Welding Steel—The Role of Fluorine. Willi M. Conn. *Ceramic Age,* v. 57, Apr. 1951, p. 38-40.

A survey of research which led to the development of ceramic fluxes based on mullite, to be used in welding steel. It is shown that the presence of a halide—for example, fluorine—is essential in welding fluxes for controlling the viscosities of the molten metal and flux, and for the production of excellent welds. The influence of moisture on the loss of F from a ceramic batch. Production methods for ceramic fluxes, based on results of the tests. 10 ref. (K1, ST, EG-k)

274-K. Steel Radiator Production. *Welding & Metal Fabrication,* v. 19, Apr. 1951, p. 122-128.

Equipment and procedures of British firm. Presswork, automatic gas welding, and spot welding are the principal procedures. (K2. K3, G1, CN)

275-K. Productivity and Welding. H. West. *Welding & Metal Fabrication,* v. 19, Apr. 1951, p. 129-132.

Application of various welding processes in order to improve productivity. (K general)

276-K. Argon-Arc Welding Light Alloy Pipe and Tubes. C. Lewis Bailton. *Welding & Metal Fabrication,* v. 19, Apr. 1951, p. 149-151.

Practical development work on argon-arc welding of Al tubes. Successful results were obtained by the use of special procedure. Overhead and vertical welding was also achieved. (K1, Al)

277-K. Heat-Resistant Alloys. H. E. Lardge. *Aircraft Production,* v. 13, Mar. 1951, p. 84-87; Apr. 1951, p. 121-123.

Application of welding processes to sheet materials for gas turbines. Mild steel, austenitic 18-8 steel, Inconel, 80-20 Ni-Cr, and a 23-12-3-1 Cr-Ni-W-Si alloy were investigated. Part I: fusion welding, torch welding, carbon-arc, argon-arc, metallic-arc, resistance, and spot welding. Second installment: other forms of resistance-welding and the electrical hot-riveting process. Micrographs and macrographs illustrate structures obtained. 20 ref. (K general, CN, SS, Ni, SG-h)

278-K. Metal-Bonding. F. H. Parker. *Aircraft Production,* v. 13, Apr. 1951, p. 107-114.

Development work on metal adhesive processes by the Bristol Aeroplane Co., Ltd., with emphasis on use of the Redux process on Al alloys. (K12, Al)

279-K. Reports of International Welding Commissions. *Transactions of the Institute of Welding,* v. 14, Feb. 1951, p. 5-12.

Reports of 5 Commissions presented at June 1950 meeting: gas welding and allied processes; arc welding; control, testing, and measuring of welds; hygiene and safety; and fatigue testing procedures and equipment for welds. (K general)

280-K. Welded Bridges and Hangars in Spain. E. Torroja. *Transactions of the Institute of Welding,* v. 14, Feb. 1951, p. 13-21; disc. p. 22-23. (K general, T26, CN)

281-K. The Industrial Use of Flash Welding, Dealing in Particular With Ferrous Materials. *Welding Research,* v. 5, Feb. 1951, (bound with *Transactions of the Institute of Welding,* v. 14), p. 135r-146r.

A guide for industrial users of the process, in connection with the welding of ferrous materials. The process can also be applied to some nonferrous metals, including Al alloys. (K3, Fe, ST, Al)

282-K. Hard Soldering Aluminum and Its Alloys. (In French and German.) E. Zurbrügg. *Aluminium Suisse,* Mar. 1951, p. 52-61.

Differences between welding, hard soldering, and soft soldering. Procedures, equipment, solder and flux compositions, applications, and properties. (K7, Al)

283-K. Spherical Pressure Tank Welded From Stainless Plate. *Metal Progress,* v. 59, Apr. 1951, p. 516-517.

Arc weld fabrication and use of an "exploded" cube design. (K1, T26, SS)

284-K. Effect of Repeated Machine Welding. *Metal Progress,* v. 59, Apr. 1951, p. 562, 564. (Condensed from "Effect of Repeated Welding on the Physical and Metallurgical Properties of A-212 Plate"; *Babcock and Wilcox Co.,* Report 3363; *U. S. Atomic Energy Commission,* NP-1700.)

Effects of submerged-arc welding on microstructures and mechanical properties. No detrimental effects were observed. (K1, CN)

285-K. Pressure-Welded Copper Alloys. *Metal Progress,* v. 59, Apr. 1951, p. 544, 546. (Condensed from "The Pressure-Welding Characteristics of Some Copper-Base Alloys", Edwin Davis and Eric Holmes.)

Previously abstracted from *Journal of the Institute of Metals.* See item 393-K, 1950. (K2, Cu)

286-K. Metal-to-Glass Seal. *Metal Progress,* v. 59, Apr. 1951, p. 556, 558, 560. (Condensed from "A Nickel-Chromium-Iron Alloy for Sealing to Glass", J. E. Stanworth.)

Previously abstracted from *Journal of Scientific Instruments.* See item 686-K, 1950. (K11, T1, Ni, Fe)

287-K. Welding of Armor. *Metal Progress,* v. 59, Apr. 1951, p. 580, 582. (Condensed from "Developments in the Welding of Armor", T. L. H. Butterfield.)

Previously abstracted from *Welder.* See item 22-562, 1947. (K1, T2, CN)

288-K. Aluminum Boxes Inert-Arc Welded. *Iron Age,* v. 167, May 3, 1951, p. 99.

Technique developed at Federal Telephone and Radio Corp., Clifton, N. J. The boxes are mass-produced in three different styles for enclosing military communications equipment. (K1, Al)

289-K. Liquefied Nitrogen Storage Vessel Fabricated by Welding. Bartlett West. *Modern Machine Shop,* v. 23, May 1951, p. 198-200, 202.

Fabrication of spherical vessel from stainless steel plate, 3 11/16 in. thick, using Heliarc welding. (K1, SS)

290-K. Modern Equipment at Work. Jet Engine Rings Fabricated From Titanium Bar Stock. *Modern Machine Shop,* v. 23, May 1951, p. 214.

Rings for aircraft jet-engine components are successfully flash-butt welded from titanium stock having a cross-section area of 2 sq. in. at American Welding & Mfg. Co., Warren, Ohio. (K3, Ti)

291-K. Center Studs Brazed to Brass Candy Dishes With Induction Heating Equipment. *Modern Machine Shop,* v. 23, May 1951, p. 218, 220. (K8, Cu)

292-K. Welded Differential Housing 20 Per Cent Lighter. R. R. Kilgore. *Steel,* v. 128, May 7, 1951, p. 121.

How 20% weight reduction, maintaining maximum rigidity, resulted from redesigning the rear-axle differential housing of large self-propelled earth movers for welded fabrication. (K1, T7, CN)

293-K. How Ore Cars Were Reconditioned by Welding. *Railway Mechanical and Electrical Engineer,* v. 125, May 1951, p. 65-69. (K general, T23, CN)

294-K. Reduce Weld Cleaning Costs. Bernard J. Smolka and Herbert Gefvert. *Industry & Welding,* v. 24, May 1951, p. 24-26.

Use of antispatter compounds. Material welded is mild-steel plate. (K1, CN)

295-K. All Welded Barges for the Army Transportation Corps. Lloyd F. Green. *Industry & Welding,* v. 24, May 1951, p. 28-30. (K general, T22, CN)

296-K. New Resistance Welding Technique. Clarence Broner. *Industry & Welding,* v. 24, May 1951, p. 42.

Relatively new process uses either a seam or projection-type welder to obtain a clean, smooth end-to-end joint without metal overlap or protruding metal on joined edges of the sheets. (K3)

297-K. Repair and Conversion of Heavy Freighters. J. W. Massenburg and Charles Hutchinson. *Industry & Welding,* v. 24, May 1951, p. 44-46, 48.

Use of automatic submerged-arc welding. (K1, T22, CN)

298-K. Explosion Test Used in Weld Studies. W. S. Pellini and C. E. Hartbower. *Iron Age,* v. 167, May 10, 1951, p. 83-87.

Advantages of explosion bulge testing of welds under controlled biaxial stress conditions. Various types of welds in steel plate were tested with both circular and ellipsoidal bulges. Concepts of weld-deformation mechanics deduced from the bulge studies were found to be general to weld performance, not specific to high rates of loading. (K9, CN)

299-K. Ceco Builds Bailey Bridges. Clyde B. Clason. *Welding Engineer,* v. 36, May 1951, p. 21-25.

Welding equipment and procedures of Ceco Steel Products Corp., Chicago. (K1, T26, CN)

300-K. 15-Ton Aluminum Crane Inert-Arc Welded. W. F. Walker. *Welding Engineer,* v. 36, May 1951, p. 26-27, 31.

Equipment and procedures. (K1, T5, Al)

301-K. Welding Aids Truck Body Manufacture. Fred M. Burt. *Welding Engineer,* v. 36, May 1951, p. 28-31.

Gas and arc welding equipment and procedures of Advance Auto Body Works, Los Angeles. (K1, K2, T21, CN)

302-K. Internal Clamp for Pipe Welding. William R. Harper. *Welding Engineer,* v. 36, May 1951, p. 32-33, 56.

Clamp helps cut down electrode waste and welding time in field welding of oil pipeline. (K1, CN)

303-K. Welding for Window Dressing. W. C. Henzlik. *Welding Engineer,* v. 36, May 1951, p. 35-37, 42.

Procedure for creating fancy window displays and racks from steel wire using gas and resistance welding. (K2, K3, CN)

304-K. Field-Welded Digesters for the Columbia Cellulose Company. P. E. Savage. *Engineering Journal,* v. 34, Apr. 1951, p. 286-294.

History, preliminary planning, choice of electrodes and joints, radiographic inspection, shop fabrication, field assembly and welding, and stress relief. (K1, T29, CN)

305-K. Adhesion of Polyethylene and Polystyrene to Steel. Gerard Kraus and James E. Manson. *Journal of Polymer Science,* v. 6, May 1951, p. 625-631.

In polymer-metal adhesion, London dispersion forces alone contribute overwhelmingly to the total specific adhesion, and effective adhesion is not necessarily related to specific adhesion. (K11, ST)

306-K. Welding in Ship Construction. K. M. Lawson. *Australasian Engineer,* v. 44, Jan. 8, 1951, p. 44-54; disc., p. 54-55.

Changes necessitated by a changeover from riveted to welded construction in the shipyard. Equipment and procedures. (K1, T21, CN)

307-K. The Fabrication of Steel Keelplate. S. M. Algar. *Welder,* v. 19, Oct.-Dec. 1950, p. 80-82.

Use of arc welding by a British firm. (K1, T22, CN)

308-K. Making Rear Axle Casings for the Ford Consul and Zephyr Cars. *Machinery* (London), v. 78, Apr. 19, 1951, p. 627-638.

Arc welding and machining equipment, showing various stages in manufacture. (K1, G17, T21, CN)

309-K. Autogeneous Rail Welding. (In German.) J. Kunz and W. Raabe. *Schweissen und Schneiden,* v. 3, Mar. 1951, p. 73-83.

Effect of production methods and steel compositions on weldability of rails; mechanical properties and testing of rail welds; preparation of weld joints; and welding procedures. 13 ref. (K9, T23, CN)

310-K. Advances in the Field of Welding and Cutting. (In German.) *Schweissen und Schneiden,* v. 3, Mar. 1951, p. 91-96.

Brief discussion precedes a bibliography of 164 ref. (K general, G22)

311-K. Soldering With the Aid of High-Frequency Heat. (In French and German.) A. Leemann. *Zeitschrift für Schweisstechnik; Journal de la Soudure,* v. 41, Mar. 1951, p. 46-48; Apr. 1951, p. 63-70.

Principles and advantages. (K7)

312-K. Welding Sews up a Cost Problem. Charles G. Herbruck. *American Machinist,* v. 95, May 14, 1951, p. 142.

How Baltimore Broom Machine Co. converted from casting to weldments on their automatic broom-sewing machine, with a cost cut of 36%. (K1, T5, ST)

313-K. Welding High Yield Pipe. Carl J. Coulter. *Petroleum Engineer,* v. 23, May 1951, p. D52, D54.

Use of high-tensile strength steel in line pipe is an important economic factor. Results of welding thin-walled pipe. (K general, CN)

314-K. New Welding Methods for Tough Jobs. *Product Engineering,* v. 22, May 1951, p. 124-125.

Survey of several new arc, spot, and cold welding processes. (K1, K3, K5)

315-K. Welded Fasteners for Roofing and Siding. *Railway Engineering and Maintenance,* v. 47, May 1951, p. 456-458.

Relatively new way of applying roofing and siding materials, by which building contractors are reported to be effecting savings of 25-60% as compared with older methods. (K1, T26, CN)

316-K. Cast Weld Construction. Jack Osborn Felt. *Welding Journal,* v. 30, May 1951, p. 415-423.

Various examples of this type of construction. Show how gains can often be achieved by redesign for its use. Steel castings are joined by welding to produce finished products or parts. Largely of a summary of papers presented at the 5th Annual Technical and Operating Conference, Steel Founders' Society of America. (K general, E general, CI)

317-K. Arc Welding Stainless Steel Without Columbium. Richard K. Lee. *Welding Journal,* v. 30, May 1951, p. 447-449.

Previously abstracted from *Machinery* (American). See item 185-K, 1951. (K1, SS)

318-K. Design Data for Brazing. Part I. W. J. Van Natten. *Welding Journal,* v. 30, May 1951, p. 452-454.

Recommended by the Welding Section of the Schenectady Works Laboratory of General Electric Co. (To be continued.) (K8)

319-K. Construction of Fishing Trawler. William A. Palmer. *Welding Journal,* v. 30, May 1951, p. 454-455.

Techniques for flame cutting and arc welding. (K1, G22, T22, CN)

320-K. Silver Brazing Used on Billion-Volt Machine. E. W. Moles. *Welding Journal,* v. 30, 1951, p. 456-457.

Use in joining parts of the copper coil of the 2-3 billion electron-volt cosmotron at the Brookhaven National Lab. (K8, CN)

321-K. Aluminum Boxes Welded. *Welding Journal,* v. 30, May 1951, p. 460.

New method of machine-welding (Heliarc method) large quantities of rectangular Al boxes, used to enclose various types of communications equipment for the Signal Corps and other branches of the Armed Services. (K1, Al)

322-K. A Welded Aircraft Hangar. O. Bordsgaard. *Welding Journal,* v. 30, May 1951, p. 461-462. (Translated

and condensed from *l'Ossature Métallique*, v. 15, Dec. 1950, p. 589-594.)

Welded design of a Danish structure. (K1, T26, CN)

323-K. Physical and Welding Metallurgy of Chromium Stainless Steel. Helmut Thielsch. *Welding Journal*, v. 30, May 1951, p. 209s-250s.

Reviews published and unpublished information on martensitic and ferritic stainless steels with emphasis on their physical and welding metallurgy. Brittleness, sigma-phase embrittlement, high-temperature embrittlement, notch-sensitivity, and effects of various alloying elements were studied. 213 ref.
(K9, Q23, SS)

324-K. Measuring the Tungsten Consumption in Inert Gas Arc Welding. G. Urbain. *Welding Journal*, v. 30, May 1951, p. 260s-264s.

Use of the radioactive tracer technique using W^{187} to measure W losses in plate and weld metal, also fumes in inert-gas arc welding of 18-8 stainless steel. (K1, S19, SS)

325-K. Static and Fatigue Tests on Spot-Welded Trusses. Artemy S. Joukoff. *Welding Journal*, v. 30, May 1951, p. 264s-265s. (Translated and condensed.)

Previously abstracted from *Revue de la Soudure.* See item 20-K, 1951. (K9, K3, Q28, Q7, CN)

326-K. Rubber-to-Metal Bonding. *Aircraft Production*, v. 13, May 1951, p. 131-132.

Adaptation of the Redux process to the bonding of rubber to metal for sealing-strips on the engine-bay doors of the de Havilland Comet.
(K11)

327-K. The Welding of Light Alloys; Effects of Variations of Metal Composition on Contraction Cracks. (In French.) M. Hollard. *Soudure et Techniques Connexes*, v. 4, Nov.-Dec. 1950, p. 240-247.

Study of crack formation in welds in light alloys. Crack curves were plotted for "Duralinox" for variable Mg contents and fixed proportions of Fe, Si, and Mn. Certain types of "Duralinox" and "Almasilium" showed no cracks. Certain types of Duraluminum showed only a limited tendency toward crack formation. 11 ref. (K9, Al)

L

CLEANING, COATING AND FINISHING

326-L. Metal Finishing Progress in 1950. Walter A. Raymond. *Metal Finishing*, v. 49, Jan. 1951, p. 48-54.
110 references. (L general)

327-L. Metal Cleaning. D. W. Vance. *Metal Finishing*, v. 49, Jan. 1951, p. 55-57, 73.

Factors in selecting cleaners, solvent cleaners, emulsion and emulsifiable cleaners, alkaline cleaners, cleaning actions, electrocleaning, and acid cleaners. (L12)

328-L. Bright Chromizing—The Onera Process. Phillippe Galmiche. *Metal Finishing*, v. 49, Jan. 1951, p. 61-64.

See abstract of "Chromizing—Details of a Process for Forming Chromium-Rich Layers on Steel," *Sheet Metal Industries*, item 570-L, 1950.
(L15, ST, Cr)

329-L. The Effect of Operating Conditions on the Hardness of Chromium Plate. R. E. Howell. *Metal Finishing*, v. 49, Mar. 1951, p. 50-56, 69.

Reviews the literature and gives details of experimental work. In all cases, Cr was deposited on polished steel plates.
(L17, Q29, Cr, ST)

330-L. Strike Baths. J. B. Mohler. *Metal Finishing*, v. 49, Mar. 1951, p. 57-59, 69.

The basic plating cycle consists of the following steps: clean, rinse, etch, rinse, plate, and rinse. One of the common deviations is insertion of a "strike" step before the plate step to improve bond or covering power. This step consists of a flash deposit of another metal. The three basic types are the tin, copper, and silver strikes. (L17)

331-L. Anode Maintenance in the Alkaline Stannate Tin Plating Bath. F. A. Lowenheim. *Metal Finishing*, v. 49, Mar. 1951, p. 60-64.

Chemistry of this type of plating and recommendations for anode maintenance—an important factor in successful Sn plating. (L17, Sn)

332-L. Experiments in Chromium Plating From Non-Aqueous Media. A. L. Hanson, D. Frokjer, and D. Mitchell. *Metal Finishing*, v. 49, Apr. 1951, p. 48-49, 69.

Reviews literature and describes experimental work. Immediate objectives were to determine whether Cr in valences other than 6 can be used for electrodepositions and to observe whether or not sulfate addition would be necessary.
(L17, Cr)

333-L. The Function of Sulphites and Bisulphites in Cyanide Plating Solutions. Joseph Haas. *Metal Finishing*, v. 49, Apr. 1951, p. 64-65.

Fundamental chemistry of the above, and its application to plating practice. Applicable to deposition of Cu and Zn. (L17, Cu, Zn)

334-L. Manufacturing Applications of Liquid Impact Blasting. B. H. Marks. *Metal Treating*, v. 11, Mar.-Apr. 1951, p. 2-4; disc. p. 5.
(L10)

335-L. Tomorrow's Products Tested Today. Warren W. Smith. *Organic Finishing*, v. 12, Apr. 1951, p. 13-16.

Test procedures and equipment for determining life of protective coatings and finishes at South Florida Test Service, Miami. (L26)

336-L. Finishing Metal Kitchen Cabinets. George K. Clapper. *Industrial Finishing*, v. 27, Apr. 1951, p. 28-30, 32.

Equipment and procedures of Alabama Metal Products Co.
(L general, T10, ST)

337-L. Hot Synthetic Enamel Used For Painting Farm Tractors. Robert Johnson. *Industrial Finishing*, v. 27, Apr. 1951, p. 48-50, 52.

Equipment and procedures of Massey-Harris Co. (L26, ST)

338-L. High-Temperature Protection of a Titanium-Carbide Ceramal With a Ceramic-Metal Coating Having a High Chromium Content. Dwight G. Moore, Stanley G. Benner, and William N. Harrison. *National Advisory Committee for Aeronautics*, Technical Note 2329, Mar. 1951, 31 pages.

The ceramal contained 80% TiC and 20% Co. The coating, designated A-479M, contained 80% Cr and 20% alkali-free frit (glass). It was prepared as a slip, with clay as floating agent, and applied to the ceramal by dipping or spraying, then firing at 2000° F. for 10 min. in a purified H_2 atmosphere. Fired coating was hard, smooth, and adherent.
(L27, Ti, Co, Cr, C-n)

339-L. Remarks on the Properties of Anticorrosive Pigments and Their Vehicles. Manfred Ragg. *Paint, Oil & Chemical Review*, v. 114, Apr. 12, 1951, p. 16-17, 28-30.

Fundamental mechanisms of action and practical properties of various types of pigments. Results of some new experiments. Concerned entirely with protection of iron and steel surfaces. (L26, CI, ST)

340-L. Hot Surface Marine Paint. Henning L. Warnecke. *Paint, Oil & Chemical Review*, v. 114, Apr. 12, 1951, p. 31, 34.

Problem of painting steel or cast-iron surfaces to withstand temperatures of 800-1300° F. Although there is no organic film-former or oil that will not disintegrate or carbonize at such temperatures, it is possible to apply a coating containing Al flake or Zn dust. If the surface has been properly prepared, the metallic particles will fuse into the base metal while the vehicle burns away, leaving a protective coating of Al or Zn. (L26, CI, ST)

341-L. Recent Developments in Metal Spraying by the Powder Process. W. G. McDermott. *Electroplating and Metal Finishing*, v. 4, Apr. 1951, p. 114-116, 131.

New features of the latest "Schori" metal-spraying gun, which produces denser, more adherent coatings of extremely low oxide content at much greater speed. Efficiency of deposition is increased and application costs lowered; while the new gun is capable of handling metals of high melting point which could not previously be sprayed by the powder process. (L23)

342-L. Brush-Backed Polishing. *Electroplating and Metal Finishing*, v. 4, Apr. 1951, p. 117-119.

New method of metal-surface preparation and its advantages. (L10)

343-L. Electrolytic Polishing of Aluminium. *Electroplating and Metal Finishing*, v. 4, Apr. 1951, p. 119.

Reviews recent British patent specification. (638,321.) (L13, Al)

344-L. Notes on the Production of Aluminium Reflector Surfaces. *Electroplating and Metal Finishing*, v. 4, Apr. 1951, p. 121-122.

Materials, mechanical polishing, degreasing and cleaning, electrolytic brightening, and rinsing.
(L10, L12, L13, Al)

345-L. Coated Abrasives in the Grinding & Polishing of Stainless Steel. Part B. After Fabrication. A. E. Brown. *Electroplating and Metal Finishing*, v. 4, Apr. 1951, p. 123-126.

Restoration of the finish on small areas which have become marred during fabrication as a result of welding, tooling, machining, etc.
(L10, SS)

346-L. Heavy Chromium Plating of Crankshafts. *Electroplating and Metal Finishing*, v. 4, Apr. 1951, p. 127-128.

Solutions and operating conditions used by a European plant. Two methods for stripping faulty deposits. (L17, Cr)

347-L. Removing Weld Discoloration. *Sheet Metal Worker*, v. 42, Apr. 1951, p. 40, 96.

A simple method designed for cleaning interior welded seams and corners of stainless steel. (L12, SS)

348-L. Pickling of Monel, Nickel, and Inconel. *Wire Industry*, v. 18, Apr. 1951, p. 365-367.

Suggested pickling solutions for various applications. (L12, Ni)

349-L. The Electrodeposition of Silver-Cadmium Alloys. Isvaran Nambissan and A. J. Allmand. *Transactions of the Faraday Society*, v. 47, Mar. 1951, p. 303-314.

Electrodeposition from complex cyanide solutions at controlled cathode potentials. The alloys used analyzed 1.6-100% Ag. Results are explained in terms of the deposition of primary lattices of α, ζ, δ, and ε types, depending on conditions.
(L17, Ag, Cd)

350-L. Automatic Barrel Plating. *Metal Industry*, v. 78, Mar. 30, 1951, p. 247-250.

New British plant for Zn plating bolts, nuts, and screws.
(L17, Zn, ST)

351-L. From a Metallurgist's Notebook: Enamel Adhesion. H. H. Symonds. *Metal Industry,* v. 78, Apr. 6, 1951, p. 270.

In order to ascertain reasons for exfoliation of enamel from motorcar nameplates, an investigation was made of possible causes. It was found that no flaws, laminations, or other defects existed; hence, the principal reason for exfoliation was poor quality of the enamel. The base metal contained about 90% Cu. (L27, Cu)

352-L. Lithium in Vitreous Enamels. S. Hallsworth. *Foundry Trade Journal,* v. 90, Apr. 5, 1951, p. 369-372.

See abstract under similar title from *Sheet Metal Industries,* item 153-L, 1951. (L27, ST)

353-L. The Alodine Process for Galvanic Protection of Aluminium. (In French.) Claude Hess. *Revue de l'Aluminium,* v. 28, Feb. 1951, p. 44-50.

Surface treatment for Al and its alloys, designed to facilitate the adhesion of paints. Surfaces are immersed in an acid bath containing essentially PO_4, F, and CrO_2 ions. The treatment is carried out without use of electric current. Mechanism of operation appears to consist in formation of a complex coating of alumina and Al salts. Laboratory tests show that this coating provides good protection against corrosion. 17 ref. (L14, Al)

354-L. Modern Methods of Copper-Plating Iron and Steel and of Nickel-Plating Copper Alloys (Copper, Brass, Bronze). Part II. Nickel-Plating Copper Alloys. (In French and German.) Roger Zirilli. *Pro-Metal,* v. 4, Apr. 1951, p. 811-820.

Operations and required equipment. Defects, possible causes, and remedies. (L17, Cu, Ni, Fe, ST)

355-L. The Problem of the Structure of Vapor-Deposited Iron Coatings. (In German.) Carl Heck. *Zeitschrift für Metallkunde,* v. 42, Jan. 1951, p. 10-13.

Structures differ with temperature of the material on which the Fe vapor is deposited. The deposit on a cold base consists partly of ferromagnetic and partly of nonferromagnetic particles; while deposits on a hot base consist entirely of ferromagnetic material.

(L25, M27, Fe)

356-L. A Method for Determining the Cathodic Distribution of Current and Metal in Galvanic Electrolytes. (In German.) Julius Steiner. *Archiv für Technisches Messen,* Jan. 1951, T6-T7 (4 p.)

New method for determining the distribution of metal on the cathode. Criticizes earlier methods. (L17)

357-L. Chromium-Plating of Light-Metal Cylinders. (In German.) Erich Meyer-Rässler. *Metalloberfläche,* v. 3, sec. B, p. 33-42.

Procedures for producing hard Cr and porous Cr plating and their mechanical and thermal properties. 10 ref. (L17, T25, Al, Cr)

358-L. On the Blisters Produced on the Evaporated Aluminium Film. (In English.) Shigenori Nawata. *Science Reports of the Research Institutes, Tohoku University,* ser. A, v. 2, Apr. 1950, p. 331-340.

Comparative studies were made of continuous and discontinuous evaporation of thin Al films on glass. It was thus found that continuous evaporation is liable to produce blisters on the evaporated surface. Production of these blisters was studied. Recommendations for avoiding such blisters. (L25, Al)

359-L. Decorating Plastic Parts by Metallizing. *Automotive Industries,* v. 104, May 1, 1951, p. 54, 84, 86.

(L23)

360-L. Improved Finishing Machine for Zn Base Die Castings. *Automotive Industries,* v. 104, May 1, 1951, p. 58.

The "Gyro-Finisher," a new abrasive tumbling machine developed by Ternstedt Div., General Motors Corp. (L10, Zn)

361-L. Surface-Preparation Values and Sandblasting Economics. A. J. Liebman. *Marine Engineering and Shipping Review,* v. 56, May 1951, p. 53-56.

Previously abstracted from *Organic Finishing.* See item 825-L, 1950. (L10, CN)

362-L. Liquid Impact Blasting of Die Casting Dies. B. H. Marks. *Die Castings,* v. 9, May 1951, p. 23-24, 26. (Based on "Manufacturing Application of Liquid Impact Blasting," *Tool Engineer*).

Previously abstracted from original. See item 169-L, 1951. (L10)

363-L. Barrel Finishing of Die Castings: A Survey of Materials, Methods, and Equipment. *Die Castings,* v. 9, May 1951, p. 39-40, 42-43, 46-50, 52-53, 68-69.

(L10)

364-L. HAE: Revolutionary New Coating for Magnesium. *Magazine of Magnesium,* May 1951, p. 1-3.

Electrolytic finish said to have excellent corrosion resistance, high melting point, good dielectric strength and hardness. It has a normally brown color of varying shades and is an excellent paint base. (L13, Mg)

365-L. Medalmaker Increases Production With Automatic Sandblasting Equipment. *Modern Machine Shop,* v. 23, May 1951, p. 224.

Use in production of medals, plaques, and medallions. (L10)

366-L. Ingenious Blast Cleaning Adapted to Mass Production. W. I. Gladfelter. *Iron Age,* v. 167, May 3, 1951, p. 100-104.

How special blast cleaning equipment has increased cleaning production as much as 40%. Two-speed drives on monorail conveyers through blast cabinets, multi-angle blast streams, and rotating tables are some of the ingenious equipment in use. (L10)

367-L. Substitute Protective Coating Materials for Bottle Caps and Jar Closures. Albin H. Warth. *Modern Lithography,* v. 19, May 1951, p. 61, 63. (L26)

368-L. Properties and Uses of Tin. W. H. Dennis. *Mine & Quarry Engineering,* v. 17, May 1951, p. 149-155.

Survey of fabrication procedures, with emphasis on electrodeposition and dip coating of tin on other metals. (L17, L16, Sn)

369-L. Chromium Plating of Large Drying Cylinders. A. H. Loveless. *Industrial Chemist and Chemical Manufacturer,* v. 27, Apr. 1951, p. 166-170.

Plant for Cr plating of large cast-iron cylinders. (L17, Cr, CI)

370-L. R-108—A New Concept in Protective Coating Intermediates. E. L. Tinnes and C. L. Chase. *Paint, Oil, & Chemical Review,* v. 114, Apr. 26, 1951, p. 14, 16-17.

Properties and formulation recipes for new material developed by General Electric Co. A high level of corrosion resistance is claimed. (L26)

371-L. The Use of Steel Shot in Airless Cleaning of Forgings. Nelson S. Mosher. *Steel Processing,* v. 37, Apr. 1951, p. 175-178, 205.

Recommended procedures.

(L10, ST)

372-L. The Technology of Porcelain Enameling on Steel. Edward E. Marbaker. *Mechanical Engineering,* v. 73, May 1951, p. 386-392.

History; composition of enamels; preparation of enamel slips; manufacturing enamel frit; opacification; colors; enameling iron; preparation of sheet-metal surfaces for enameling; enameling process; properties of enamels; and uses of porcelain enamel. (L27, ST)

373-L. A Study of Spalling Found in Porcelain Enamel After Repeated Freezing and Thawing in the Presure of Moisture. R. J. McEvoy and A. I. Andrews. *Journal of the American Ceramic Society,* v. 34, May 1951, p. 135-141.

Study was made in connection with defects found on porcelain-enamel liners in cold-wall domestic refrigerators. A test machine was built to duplicate the environment. It was found that enamels with a low bubble structure were superior in spall resistance. Ti enamel appeared better than other types, particularly when a clay of the kaolin type was used as suspending agent. (L27)

374-L. A Qualified Trio Answers the Three Major Objections to Enameling Aluminum. *Ceramic Industry,* v. 56, May 1951, p. 60-61.

Albert J. Schmidt, Director of Research, American Porcelain Enamel Co.; I. R. Seely, Factory Manager, Kawneer Co.; and John B. Clark, Ceramic Engineer, Foote Mineral Co. briefly discuss the above.

(L26, Al)

375-L. Tumble Finishing Technique. Hubert M. Goldman. *Tool Engineer,* v. 26, May 1951, p. 37-40.

Dry and wet processes, available compounds and their properties, and operating factors. (L10)

376-L. Sealing of Anodized Aluminum Increases Corrosion Resistance. A. E. Durkin. *Iron Age,* v. 167, May 10, 1951, p. 96-98.

Sealing, which is the final step in the anodic process, is that operation which closes the pores of the anodic coating to make it nonadsorptive and stainproof. It alters the anodic coating to a monohydrate and increases its life and weathering resistance. It was found that anodized Al sealed in high-purity water with a pH controlled at or near 6 has approximately 35% more corrosion resistance than when sealed in ordinary tap water where no pH control was exercised.

(L19, R general, Al)

377-L. The Finishing of Light Alloys. Jerome L. Bleiweis. *Metal Finishing,* v. 49, Feb. 1951, p. 49-55.

Correlated review, in outline form, of the various processes used for application of inorganic chemical or "conversion" coatings and of plated metallic coatings, to Al and Mg and their alloys. Purpose, nature of coating, treatment cycle, and comments on each specific type.

(L14, L17, Al, Mg)

378-L. Rapid Calculation of Job Plating Prices on Small Miscellaneous Shapes. *Metal Finishing,* v. 49, Feb. 1951, p. 60-62.

Tables facilitate calculation.

(L17)

379-L. Using Substitute Chemicals in Plating Baths. *Metal Finishing,* v. 49, Feb. 1951, p. 63-64, 72.

Three brief articles as follows: "Nickel Plating Without Nickel Chloride", Myron B. Diggin: "Avoiding Difficulties Caused by Shortages of Nickel Materials" (anon); and "Substituting Zinc Oxides for Zinc Cyanide in Plating Solutions", Myron B. Diggin. (L17)

380-L. Continuous Anodizing of Aluminum Coiled Sheet. Charles J. Simon. *Metal Finishing,* v. 49, May 1951, p. 63-64.

Machine whose functions are to anodize, clean, etch, seal in wax, and recoil the sheet stock, developed for Monarch Metal Weatherstrip Corp., St. Louis. (L19, Al)

381-L. Plating and Finishing Tubing at Spang-Chalfant. *Metal Finishing,* v. 49, May 1951, p. 65.

Tubing made in an electric resistance-weld tube mill and its surface finishing consisting of Zn electroplating the exterior and lacquer coating the interior.
(L17, L26, ST, Zn)

382-L. NPA Rulings Affecting the Plating Industry. *Metal Finishing,* v. 49, May 1951, p. 74-75, 111-115.

Several important changes in the regulations for plating. Includes detailed lists of articles affected. (L17)

383-L. Hot Spraying of Lacquer. James A. Bede. *Plating,* v. 38, May 1951, p. 461-463, 470.

Principles, procedures, and equipment. Emphasizes advantages. (L26)

384-L. The Electroplating Industry in Atlanta. II. Victor J. Baran. *Plating,* v. 38, May 1951, p. 464, 469-470.

Concludes review. (L17)

385-L. Making Electrotypes. Edward F. Lynch. *Plating,* v. 38, May 1951, p. 465-468.

Electrotyping is the process of producing duplicates from letterpress material by electrodepositing Cu or Ni or both on molds taken from the originals. Picture story of the individual steps taken in the production of curved electrotypes for rotary-press printing.
(L17, Cu, Ni)

386-L. Power Brushing as a Production Tool. *Magazine of Tooling and Production,* v. 17, May 1951, p. 46-47, 96.

New applications developed at Osborn Mfg. Co., Cleveland. (L10)

387-L. Bright Silver Plating in the Hollow-Ware and Spoon and Fork Trade. H. E. Hutchinson. *Journal of the Electrodepositors' Technical Society,* v. 25, 1950, p. 189-197; disc. p. 197-201. (Preprint)

Deposition of Ag from solutions containing Turkey red oil and CS_2.
(L17, Ag)

388-L. The Structure of Electrodeposited Metals. A. W. Hothersall. *Journal of the Electrodepositors' Technical Society,* v. 25, 1950, p. 203-210. (Preprint)

Lecture is intended to provide a simple qualitative picture. Relation between conditions of electrodeposition and structure and surface geometry of the base metal.
(L17, M26)

389-L. Studies in the Discontinuities of Electrodeposited Metallic Coatings. Parts II and III. S. C. Shome and U. R. Evans. *Journal of the Electrodepositors' Technical Society,* v. 27, 1951, 30 pages. (Advance Copies 1 and 1A)

Part II: two methods developed for measuring total uncovered area of a plated specimen. Results suggest that deposition starts from preexisting nuclei, and that if the initial number of nuclei can be increased, the porosity remaining after any given time of plating should be reduced. Other methods for minimizing porosity are suggested. Part III: Electrochemical bases of present methods of determining porosity of metallic coatings; a new method using H_2O_2; and experiments based on potential measurements which throw light on the relation between thickness and porosity. (L17, Ni)

390-L. Some Factors Affecting the Rate of Diffusion of Hydrogen Through Steel During Electrolytic Pickling. W. A. Bell, G. J. Metcalfe, and A. H. Sully. *Journal of the Electrodepositors' Technical Society,* v. 27, 1951, 18 pages. (Advance Copy 2)

Measurements of the diffusion of H_2 through mild steel and through steel of composition DTD4A during cathodic treatment in various H_2SO_4 and NaOH electrolytes. Apparent H_2 diffusion varies over wide limits between various electrolytes. For mild steel, effect of cold work on diffusion rate differs between acid and alkaline electrolytes. Variations in diffusion rate are ascribed to formation of cathodic films which affect rate of transfer of hydrogen atoms into the metal lattice. The quantity of H_2 required to cause embrittlement of steel is very much less than that required to saturate the steel. 16 ref. (L13, NI, ST)

391-L. The Electrodeposition of Bright Tin-Nickel Alloy Plate. N. Parkinson. *Journal of the Electrodepositors' Technical Society,* v. 27, 1951, 23 pages. (Advance Copy 4).

Process and bath composition. Factors affecting brightness of the deposit. The alloy plate, an intermetallic compound, is fairly hard, has a pleasing rose-pink cast, and is extremely resistant to tarnishing.
(L17, Sn, Ni)

392-L. Electrodeposition of Nickel in the Bores of Tubes Using Insoluble Anodes. A. W. Hothersall and G. E. Gardam. *Journal of the Electrodepositors' Technical Society,* v. 27, 1951, 15 pages. (Advance Copy 7.)

Method originated before World War II and applied in several plants during the war. Advantages and disadvantages. (L17, Ni)

393-L. Hard Chromium Plating of Large Cast Iron Drum-Drier Rolls. A. W. Wallbank and G. W. Airey. *Journal of the Electrodepositors' Technical Society,* v. 27, 1951, 6 pages. (Advance Copy 8)

Basic problem, preliminary calculations, plant design, trial runs, and operational details. (L17, CI)

394-L. The Crystal Structure of Metallic Electrodeposits. G. I. Finch and D. N. Layton. *Journal of the Electrodepositors' Technical Society,* v. 27, 1951, 12 pages. (Advance Copy 9)

Effect of bath conditions on crystal growth; electrodeposition on active substrates; and physical properties of electrodeposits, on the basis of theory and experiment. Includes photomicrographs and diffraction patterns of electrodeposited Fe, Ni, Sb, and Ag on different substrates. (L17, M26)

395-L. Electrodeposition on Aluminium—A Study of the Zincate Process. G. L. J. Bailey. *Journal of the Electrodepositors' Technical Society,* v. 27, 1951, 22 pages. (Advance Copy 10.)

Preparation of Al for plating; mechanism of adhesion and evaluation of adhesion strength; influence on adhesion of zincate composition, time, and temperature of immersion; and rate of formation and structure of Zn deposits. Results of recent published investigations.
(L17, Zn, Al)

396-L. Improved Pickling—Economical Working by Means of Ion Exchange. T. R. E. Kressman. *Iron and Steel,* v. 24, May 1951, p. 181-182.

A process operating in the U. S. which avoids disadvantages of H_2SO_4 pickling; and which is cheaper in operation. (L12, Fe)

397-L. Electroplating Aluminium and Aluminium Alloy Components. Part II. Electrolytes for Various Processes. E. E. Halls. *Metal Treatment and Drop Forging,* v. 18, Apr. 1951, p. 177-182.

Various electrolytes for electro-deposition of some common and rare metals on Al and its alloys. An appendix presents notes supported by test results on durability of such coatings. (L17, Al)

398-L. Blistering Phenomena of Paints in Marine Environments. W. G. O'Driscoll. *Journal of the Iron and Steel Institute,* v. 167, Apr. 1951, p. 353-357.

Investigation of the blistering of chlorinated-rubber-base paints, applied to mild-steel panels, immersed in 0.5 N NaCl, demonstrated the presence of electrolytes within the blisters. The anodic or cathodic origin of the blisters is illustrated by potential plots over a blistered surface using a Ag-AgCl electrode. Mechanism of blistering of paints on a steel surface immersed in sea water. (L26, CN)

399-L. Acid Recovery From Continuous Strip-Pickling Lines. J. Pearson and W. Bullough. *Journal of the Iron and Steel Institute,* v. 167, Apr. 1951, p. 439-445.

When an acid-recovery system is incorporated, it is essential that the combined pickling-recovery system shall be always in balance. Concentrations of acid and ferrous sulfate, and volumes of liquor to be handled at any part of the cycle, must be known in order that the correct choice of equipment may be made. This problem is treated in a general way, so that if acid-strength requirements are specified, the other relevant information can be calculated. A numerical example is given.
(L12, ST)

400-L. Plating Stainless Steel. H. H. Head. *Metal Industry,* v. 78, Apr. 13, 1951, p. 287-290.

Scale removal; polishing; racking; cleaning; activation; plating; chromium baths; and stripping. (L17, SS)

401-L. From a Metallurgist's Notebook. Faulty Chromium Deposits. H. H. Symonds. *Metal Industry,* v. 78, Apr. 13, 1951, p. 293.

Two Cr-plated jack-spindles were submitted for examination of irregularities found in the deposit. Defective areas were found on both spindles. Micro-examination revealed a cracked condition of the Cr but failed to show laminations, seams, or other defects in the base metal.
(L17, Cr)

402-L. Bright Tin-Nickel Plating. N. Parkinson. *Metal Industry,* v. 78, Apr. 20, 1951, p. 305-306; disc., p. 306.

Results of experimental investigation. By appropriate choice of fluorides and their use in the correct proportions, solutions of mixed Ni and Sn chlorides can be adjusted to deposit bright alloy plate within the desired pH range. Such solutions were stable and offered a wide metal-concentration range and a favorable metal-concentration ratio.
(L17, Sn, Ni)

403-L. Nickel Deposition in Tube Bores. A. W. Hothersall and G. E. Gardam. *Metal Industry,* v. 78, Apr. 20, 1951, p. 308-310; disc., p. 310-311.

Details of insoluble anode process developed. Tubes are mild steel.
(L17, CN, Ni)

404-L. Corrosion-Resistant Chromium Deposits. H. Silman. *Metal Industry,* v. 78, Apr. 27, 1951, p. 327-330.

Various factors involved in production of the above on steels. 16 ref. (L17, R general, ST, Cr)

405-L. Surface Protection of Light Metals by Means of Film-Forming Organic Substances. (In German.) G. Hoffmann. *Metalloberfläche,* v. 5, sec. A, Apr. 1951, p. 61-62.

Includes tabulated comparison of corrosion resistance of uncoated metal and metal coated with 11 different organic substances. (L26, Al)

406-L. Cathode Polarization Potential During Electrodeposition of Copper. I. Nonreproducibility in Acid Copper Sulfate Solutions. L. L. Shreir and J. W. Smith. *Journal of the Electrochemical Society,* v. 98, May 1951, p. 193-202.

Constant-state polarization potential of the cathode during electrodeposition of Cu from $CuSO_4$-H_2SO_4 solutions depends upon conditions of preparation and storage of the solution and time which it is kept after preparation. Freshly prepared solutions usually give fine deposits, associated with high C.S.P. values, but on storage C.S.P. value decreases and crystal structure coarsens. Evidence was obtained

that this effect is due to the presence or formation of impurities. Describes method for preparation of solutions which remain stable for several months. 24 ref. (L17, Cu)

407-L. Electrodeposition of Metals From Fused Quaternary Ammonium Salts. Frank H. Hurley and Thomas P. Wier, Jr. *Journal of the Electrochemical Society,* v. 98, May 1951, p. 203-206.

Electrolytic studies on fused mixtures of ethyl pyridinium bromide and metallic chlorides showed that the following metals can be deposited on the cathode: Ag, Cu, Bi, Pb, Sn, Ni, Co, Cd, Fe, Zn, and Al. In studies of the properties of $AlCl_3$ dissolved in fused ethyl pyridinium bromide it was found that a compound having the composition $EtPyBr \cdot AlCl_3$ is formed, and that a very low-melting eutectic occurs at 67 mole % $AlCl$. Al could be deposited from mixtures of 54-70 mole % $AlCl_3$. Smooth plating of Al on Fe, steel, Cu, bronze, brass, Pt, Pb, and Sn was accomplished using an Al anode. (L17)

408-L. The Electrodeposition of Aluminum From Nonaqueous Solutions at Room Temperature. Frank H. Hurley and Thomas P. Wier, Jr. *Journal of the Electrochemical Society,* v. 98, May 1951, p. 207-212.

Electrodeposition of Al in the form of white or shiny adherent plates on various metals was accomplished at room temperature. Satisfactory plating solution was developed. Use of an alternating current superimposed on the direct plating current greatly improved adherence; increased thickness without brittleness; increased maximum current density; somewhat lowered the voltage requirements; gave the same efficiency based on the direct current; and changed the appearance from shiny to satiny. (L17, Al)

409-L. Vinyl Dispersion Resin Metal Coatings. C. W. Patton. *Official Digest,* Apr. 1951, p. 224-232.

Process of preparing and baking organosols. Electron photomicrographs show difference in particle size of resins for organosol and plastisol use, and film surfaces before and after fluxing. Curves of tensile strengths of dispersion resin films after various baking times and temperatures. (L26)

410-L. Next Electroplating Techniques. 1. Alloy Deposition. 2. Use of Rare Metals. *Product Engineering,* v. 22, May 1951, p. 128-129.
(L17, EG-b)

411-L. New Ceramics Aid Advances in High Temperature, Electronic Fields. *Product Engineering,* v. 22, May 1951, p. 162-163.

New developments in high-temperature coatings for metals, also new ceramic dielectrics. (L27)

412-L. Wider Application Horizons for Organic Finishes. *Product Engineering,* v. 22, May 1951, p. 164-166.

New developments, with special attention to use as coatings for metals. (L26)

413-L. Barrel Deburring and Plating of Steel Stampings. Ezra A. Blount. *Products Finishing,* v. 15, May 1951, p. 28-30, 32.

How steel stampings are deburred in a two-compartment tumbling barrel with the aid of abrasives. Stampings are then plated with bright Ni in a plating barrel.
(L10, L17, ST, Ni)

414-L. Die Castings Polished for Plating by Fadgenizing and Gyro-Finishing at Ternstedt. Ezra A. Blount. *Product Finishing,* v. 15, May 1951, p. 48-49.

Use of Zn-base die castings preparatory to plating, including hand and automatic polishing, buffing, and two different barrel-finishing procedures. (L10, Zn)

415-L. Spotlighting Finishing Progress. Allen G. Gray. *Products Finishing,* v. 15, May 1951, p. 50, 52, 54, 56, 58, 60, 62, 64, 66, 68, 70.

Papers on the following subjects are summarized: Mechanism of nickel electropolishing; nondestructive thickness testing in England; evaluating aircraft primer coatings; soft grits have special properties for blast cleaning of metals; and polishing and buffing zinc-base die castings prior to plating.
(L general, S14, Ni, Zn)

416-L. The Production, Properties, and Uses of Thin Films Condensed in Vacuo. L. Holland. *Vacuum,* v. 1, Jan. 1951, p. 23-36.

Three major aspects of vacuum equipment: evaporation pressure, pumping speed and ultimate oil-vapor pressures, and use of discharge techniques for cleaning of contaminated supports. Applications and results of research work on structure and physical characteristics of films. 56 ref. (L25)

417-L. Automatic Polishing Machines. *Electroplating and Metal Finishing,* v. 4, May 1951, p. 149-151.

Advanced American designs used on small articles such as costume jewelry and cigarette lighters and particularly on cutlery. (L10)

418-L. Metal Spraying in France; A Survey of Recent Developments. J. Cauchetier. *Electroplating and Metal Finishing,* v. 4, May 1951, p. 163-164.
(L23)

419-L. From a Metallurgist's Notebook: Blemished Tableware. H. H. Symonds. *Metal Industry,* v. 78, May 4, 1951, p. 367-368.

Silver-plated nickel-silver fish knives were found to exhibit surface pits persisting through the deposit. These were considered to have their origin in defects in the base metal. Includes photomicrographs.
(L17, S15, Cu, Ag)

420-L. Rotary Pickling Plant for Handling Hot-Rolled Strip in Coils. E. W. Mulcahy. *Sheet Metal Industries,* v. 28, May 1951, p. 435-438.

The plant described performs the unique operation of opening and closing hot rolled coiled strip of all sizes up to 12 to 14 in. wide during the process of pickling, without manual preparation. (L12)

421-L. Oxyacetylene Flame Cleaning. (In French.) Cl. Mathelin. *Soudure et Techniques Connexes,* v. 4, Nov.-Dec. 1950, p. 249-257.

Procedure for removal of rust or old paint from steel plate prior to repainting. (L10, ST)

422-L. (Book) **Chrome Dur.** (Hard Chromium). 1950-51 Ed. 64 pages. Centre d'Information du Chrome Dur, Grand Palais, Porte C, Paris 8, France.

Short abstracts of papers read before the last Annual Conference, May 12th, 1950. These include: "Applications of Electropolishing and X-Ray Studies to Hard Chromium in Relation to the Influence of the Surface Condition of the Base Steel," P. A. Jacquet and A. R. Weill; "Measurement of the Microhardness of Hard Chromium Deposits," M. Le Rolland; "Summary of the Principal Uses of Chromium Plating in the Manufacture of Engineering Tools—An Outline of the Economics of Chromium Plating in Engineering Tool Manufacture," M. Martin; "Recent Advances in Chromium Plating; Results of Some Investigations," M. Meynier; "Analysis of Electrolytes by Photocolorimetry," M. Chambaud; and "Contemporary Research in France and Abroad Into Hard Chromium Plating," M. Morisset. Other papers are: "Spectrophotometric Analysis of Chromium Plating Baths," M. Jean; "Performance of Chromium Deposits in Percussion Tools," M. Armagnat; and "A Contribution to the Study of the Hardness of Hard Chromium Deposits; Experiments Carried Out in Industrial and Laboratory Vats," M. Mittene. Bibliography of 162 ref. (L17, Cr)

423-L. (Book) **Metallic and Non-Metallic Coatings for Gray Iron.** Charles O. Burgess. 1951, 76 pages. Gray Iron Founders' Society, 210 National City-E. 6th Bldg., Cleveland 14. $1.75.

Metallic coatings—sprayed metal, hot dipped, hard facing, diffusion, and electrodeposited coatings; nonmetallic coatings—organic fiinshes, vitreous or porcelain enamels; chemical conversion coatings. Also coloring and cement linings and armor. Reprint from forthcoming "Gray Iron Handbook". (L general, CI)

M

METALLOGRAPHY, CONSTITUTION AND PRIMARY STRUCTURES

103-M. Study of Precipitates of C and N in Iron With an Electron Microscope. John Radavich and Charles Wert. *Journal of Applied Physics,* v. 22, Apr. 1951, p. 367-371.

Study of the above in α-iron. The physical shapes of the precipitates were determined in each case as well as the fineness of dispersion. Results confirm the conclusions drawn from internal-friction measurements made of these alloys. Includes photomicrographs.
(M26, M21, N7, Fe, CN)

104-M. Lattice Distortion Spectrum of Evaporated Gold. P. G. Wilkinson. *Journal of Applied Physics,* v. 22, Apr. 1951, p. 419-423.

Gold was deposited in various pressures of N from 0.001 to 110μ at low temperatures. The electrical resistance, distortion spectrum, and final resistivities of the gold films are shown to be dependent on the film thickness. 25 ref.
(M26, P15, Au)

105-M. Hardmetals on WC-TiC-TaC Basis and Structure of the Carbide System WC-TiC-TaC. R. Kieffer. *Powder Metallurgy Bulletin,* v. 6, Apr. 1951, p. 22-25.

Microstructure, phase diagrams, hardness, and transverse rupture strength. (M24, Q27, Q29, C-n)

106-M. A Method for the Metallographic Preparation of Zirconium Boride. R. Wachtell. *Powder Metallurgy Bulletin,* v. 6, Apr. 1951, p. 62-66.

A new routine for polishing ZrB_2 for metallographic examination. Includes micrographs. (M21, Zr)

107-M. Examination of Metals by Polarized Light. E. C. W. Perryman and J. M. Lack. *Nature,* v. 167, Mar. 24, 1951, p. 479.

Discusses several recent papers on use of polarized light for revealing the grain structure of metals and alloys. Optical anisotropy of anodized Al and etched monel metal has been attributed to anisotropic properties of the surface film formed during anodizing or etching. A possible alternative explanation involves surface contour of the specimen. To decide which of these explanations is correct, electrolytically polished Zn and Cd, Al electropolished and anodized, and monel metal, were examined before and after evaporating a silver film onto the prepared surfaces. Results indicate that the polarization effects obtained with anodized Al and etched monel are due to surface structure and not to true optical anisotropy.
(M21, Al, Ni)

108-M. Internal Friction Measurement; Method for Investigating Structural Changes in Metals. A. S. Darling. *Metal Industry,* v. 78, Mar. 23, 1951, p. 223-225; Apr. 6, 1951, p. 271-273; Apr. 13, 1951, p. 291-292.

Although at present theory is much in advance of reliable experimental results, use of internal friction measurements may well prove to be a field of metallurgical research comparable to that now occupied by X-ray diffraction methods. 40 ref. (M23)

109-M. Micrographic, Microsclerometric, and Radiocrystallographic Detection of the Brittleness of Refined Low-Chromium Steel. (In French.) Pierre A. Jacquet, Helmut Bückle, and Adrienne R. Weill. *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences,* v. 232, Jan. 29, 1951, p. 411-413.

Metallographic studies of low-Cr steel showed that micrography can be used to detect the brittleness of carbon steel containing Cr as the only alloying element and also a relatively high P content. Microsclerometric analysis, especially x-ray, shows only very small differences between the states of cohesion and brittleness with respect to those previously observed with a Ni-Cr steel. (M21, M23, Q23, AY)

110-M. Spectrochemical Research on the Beryllium Effect in Magnesium Alloys. (In German.) Albert Keil. *Zeitschrift für Metallkunde,* v. 42, Jan. 1951, p. 13-16.

Published research indicates that Be—used to reduce the ignitability of Mg alloys is primarily concentrated in the surface of the castings and partly diffused into the adjoining zone. The Be has the undesirable effect of producing a coarser grain structure and consequent reduction in strength properties. 13 ref. (M27, Q23, Mg)

111-M. The Binary Silver-Indium System. (In German.) Erwin Hellner. *Zeitschrift für Metallkunde,* v. 42, Jan. 1951, p. 17-19.

On the basis of F. Weibke's results, a revised constitution diagram in the range 25-80% In is proposed. (M24, Ag, In)

112-M. Amorphous Germanium. (In German.) H. Richter and O. Fürst. *Zeitschrift für Naturforschung,* v. 6a, Jan. 1951, p. 38-46.

A new method for studying very thin vapor deposits. X-ray pictures and electron micrographs are evaluated and compared for molten and crystalline Ge. 18 ref. (M21, Ge)

113-M. Constitution Diagram of the Ni-O_2 System and Physicochemical Nature of the Solid Phases in This System. (In Russian.) D. P. Bogatskii. *Zhurnal Obshchei Khimii* (Journal of General Chemistry) v. 21 (83), Jan. 1951, p. 3-10.

Investigated by different methods of physicochemical analysis. Certain equilibria of processes of dissociation, reduction, and oxidation in this system were also studied, and thermodynamics of such equilibria determined. A constitution diagram of the system is presented. 18 ref. (M24, P12, R2, Ni)

114-M. Light Figures of Zinc Crystals. (In English.) Mikio Yamamoto and Jiro Watanabe. *Science Reports of the Research Institutes, Tohoku University,* ser. A, v. 2, Feb. 1950, p. 81-95.

Light figures were observed on the three principal crystallographic planes of Zn crystals, which were etched for various intervals with various concentrations of aqueous solutions of different acids, alkalis, and salts. The suitability of observed figures for determining orientations of Zn crystals with the light-figure method was examined, and light figures obtained by etching for 20 min. with a boiling saturated aqueous solution of KOH was found to be the most suitable. (M26, Zn)

115-M. Orientation Determination of Zinc Crystals by the Light-Figure Method. (In English.) Mikio Yamamoto and Jiro Watanabe. *Science Reports of the Research Institutes, Tohoku University,* ser. A, v. 2, Apr. 1950, p. 270-279.

Application of the above method to determination of orientations of Zn single crystals. Apparatus and technique. (M26, Zn)

116-M. Some Notes on the Barley Shell Structure in Iron-Silicon Alloys. R. V. Riley. *Journal of Metals,* v. 3, May 1951; *Transactions of the American Institute of Mining and Metallurgical Engineers,* v. 191, 1951, p. 412.

How this structure may be produced and used in distinguishing between higher and lower Si areas in a micro-specimen of a ferrous material. (M27, Fe)

117-M. Structures and Mechanical Properties of a Mo-Ni-Cr Cast Iron. Edward A. Loria. *American Foundrymen's Society,* Preprint 51-8, Apr. 1951, 5 pages.

Microstructure and mechanical properties of 1.2-in. diam. bars of a gray iron containing 2.77% total carbon, 1.40% Si, 1.40% Mo, 1.00% Ni, 0.05% Cr as-cast and after tempering at 400, 600, and 700° F. Photomicrographs and 12 ref. (M27, Q general, CI)

118-M. Structure and Behavior of Grain Boundaries. M. R. Achter and R. Smoluchowski. "The Physics of Powder Metallurgy", Ed. 1 (McGraw-Hill, New York), 1951, p. 77-90; disc. p. 90-91.

Some recent investigations into the nature of grain boundaries, in particular a study of preferential diffusion being made by the authors. Confined largely to work subsequent to 1940. 19 ref. (M27, N1)

119-M. Examination of Subgrain Structures With the Electron Microscope. Laurence Delisle and Gordon A. Davis. "The Physics of Powder Metallurgy", Ed. 1 (McGraw-Hill, New York), 1951, p. 214-229; disc. p. 229.

Observations on W and Cu specimens. Effects of variations in annealing and working treatments. It is believed that systematic work on cold work, recrystallization, and diffusion with the electron microscope, should throw some light on actual nature of fine subgrain structures, existence of which appears imperative to explanation of the physical behavior of metals. 17 ref. (M27, Cu, W)

120-M. Diffuse X-Ray Scattering by Disordered Binary Alloys. William J. Taylor. *Physical Review,* ser. 2, v. 82, Apr. 15, 1951, p. 279-280.

Mathematical analysis. (M22)

121-M. Metallography in Industry and Research. June A. McNicol. *Australasian Engineer,* v. 44, Jan. 8, 1951, p. 73-78.

An illustrated survey of various techniques and their applications. (M21)

122-M. An X-Ray Study of Tin-Nickel Electrodeposits. H. P. Rooksby. *Journal of the Electrodepositors' Technical Society,* v. 27, 1951, 8 pages. (Advance Copy 5.)

Crystal structure and textural properties. (M26, Sn, Ni)

123-M. An Examination of Weld Metal by Means of the Electron Microscope. J. J. Brunt and A. N. Downer. *Nature,* v. 167, Apr. 21, 1951, p. 646-647.

Example in which X-ray diffraction and chemical analysis gave conflicting evidence concerning the nature of inclusions present. Electron-microscope examination clarified the difficulty. (M21, ST)

124-M. Discussion on the Paper: "The Influence of Low Percentages of Certain Elements on the Microstructure of Pure Iron-Carbon Alloys and Cast Irons," W. J. Williams. *Journal of the Iron and Steel Institute,* v. 167, Apr. 1951, p. 374-378. (M27, Fe, CI)

125-M. Electrolytic Polishing and Oxidation of Titanium. Pierre A. Jacquet. *Metal Treatment and Drop Forging,* v. 18, Apr. 1951, p. 176, 182. (Translated from *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences.*

Previously abstracted from original. See item 62-M, 1951. (M21, Ti)

126-M. Some Industrial Applications of X-Ray Diffraction. N. J. M. Campbell. *Machinery* (London), v. 78, Apr. 19, 1951, p. 645-649.

Includes structural studies and inspection. (M22, S13)

127-M. The Stability of the Co_2Al_9-Type Structure in the Aluminum-Rich Alloys of the Aluminium-Iron-Cobalt-Nickel System. M. B. Waldron. *Journal of the Institute of Metals,* v. 79, Apr. 1951, p. 103-116.

Experimental technique for determination of the composition of the quaternary phase at the point where the eutectic relationship with $FeAl_3$ changes to the peritectic reaction. This was found to occur at the phase composition associated with the change in direction of the phase boundary and is in interesting verification of the dependence of stability of this type of intermetallic compound on electron-atom ratio. 12 ref. (M24, Al)

128-M. Replica Techniques in Electron Microscopy. A. E. Agar and R. S. M. Revell. *British Journal of Applied Physics,* v. 2, Jan. 1951, p. 8-11.

Precautions for obtaining clean and reliable replicas for study of large areas of metal surfaces. Modifications to the backed replica technique and the application of pre-shadowing in metallographic studies. (M21)

129-M. Summarized Proceedings of a Conference on the Development and Application of Fourier Methods in Crystal-Structure Analysis — London, Nov. 1950. A. J. C. Wilson. *British Journal of Applied Physics,* v. 2, Mar. 1951, p. 61-70.

23 references. (M22)

130-M. Absorption Edges on Debye-Scherrer X-Ray Photographs. R. Brooks. *British Journal of Applied Physics,* v. 2, Mar. 1951, p. 76-77.

On powder photographs taken with Kα radiation obtained by filtering X-rays from a pure metal target through the appropriate "β-filter," sharp-edged bands which are not normal powder lines may occur in the low-angle region. These are shown to be due to residual X-rays of short wavelength which produce dark bands where fluorescence of silver and bromine occurs in the photographic emulsion. Typical data are tabulated. (M22)

131-M. Electropolishing for the Micrographic Study of Light Metals Rich in Silicon. (In French.) E. Knuth-Winterfeldt. *Revue de l'Aluminium,* v. 28, Mar. 1951, p. 84-86.

Technique and apparatus developed in Denmark. The electrolyte consists essentially of methyl alcohol, butyl cellosolve, and conc. HCl. The periods of polishing are separated by short intervals during which the current is reversed; this causes the removal of the very adhesive film formed from products of anodic dissolution. Includes micrographs. (M21, Al)

132-M. Contribution to the Study of Cast Irons With High Phosphorus Content. (In French.) Jean Galey. *Fonderie,* Jan. 1951, p. 2313-2326; disc., p. 2326-2328.

A comprehensive study of constitution diagram, structure, mechanical properties, and corrosion resistance of cast iron with high P content. Results indicate that it is possible to obtain a fine homogeneous structure, mechanical properties being only mediocre; however, corrosion resistance to acids seems to be satisfactory. 18 ref. (M27, Q general, R5, CI)

133-M. Research on the Mn-In and Mn-Cd Systems. (In German.) Ulrich Zwicker. *Zeitschrift für Metallkunde,* v. 41, Nov. 1950, p. 399-400.

Preparation of the alloys and test results. Includes photomicrographs and a Mn-In constitution diagram. (M24, Mn, In, Cd)

134-M. The Ni-In System. (In German.) Erwin Hellner. *Zeitschrift für Metallkunde,* v. 41, Nov. 1950, p. 401-406.

Critical review of the literature. Includes phase diagrams and tables. 11 ref. (M24, Ni, In)

135-M. The Crystal Chemistry of Phases Richest in "B-Metal" in Alloys of the Transition Metals of the Fe and Pt Triads With Elements of the Fourth Subgroup. (In German.) Konrad Schubert and Hermann Pfisterer. *Zeitschrift für Metallkunde,* v. 41, Nov. 1950, p. 433-441.

Results of powder-diffraction study of $CoCe_2$, $PdSn_2$, $RhSn_2$, $CoSi_2$, $NiSi_2$, Ir_3Ge_7, and Pt_3In_7. Correlates the results with position in the periodic table. 34 ref. (M26)

136-M. The Fe-P-Co System. (In German.) Josef Berak. *Archiv für das Eisenhüttenwesen,* v. 22, Mar.-Apr. 1951, p. 131-135.

The constitution diagram was established by thermal, metallographic, and X-ray methods. Includes graphs, tables, and photomicrographs. (M24, Fe, Co)

137-M. Constitutional Diagrams—Establishment by High Temperature X-Ray Technique. E. C. Williams. *Metal Industry,* v. 78, May 4, 1951, p. 359-362.

With improved apparatus and technique, the difficulties which surmounted the advantages to be gained from the use of the high-temperature X-ray method for studying alloy constitution can no longer be considered serious. Suggests that the method might well be used for preliminary examination of new alloy systems. 10 ref. (M23, M24)

138-M. The Importance of Silicon in Niobium-Bearing Steels and Alloys. H. J. Goldschmidt. *Metallurgia,* v. 43, Apr. 1951, p. 157-160.

A ternary Fe-Cb silicide, with an approximate formula $Fe_4Cb_6Si_3$, was found by X-ray analysis in extracts from Cb-bearing austenitic heat resisting steels and in Se-rich ferrocolumbium. With the aid of this information, it is possible to explain satisfactorily the constitution of such steels as a collection of carbides, silicides and intermetallic compounds in an austenitic matrix, and to construct a tentative Fe-Cb-Si diagram. In heat resisting alloys containing Cb (probably also the other Group IV and V elements), Si plays, therefore, a role of comparable importance with that of C; to some extent, silicide and carbide-forming tendencies are competitive. (M24, AY)

139-M. Study of the Condition of the Surface of Fibrous Materials by Means of Replicas. (In French.) Jean-Jacques Trillat and Michel Besse. *Comptes Rendus hebdomadaires des Seances de l'Academie des Sciences,* v. 232, Feb. 12, 1951, p. 608-610.

Using a solution of gelatine and water, replicas of industrially used fibers, such as nylon, rayon, and papers were obtained, for microscopic study. The same method can also be used for studying metal surfaces. (M21)

140-M. Heterogeneity of Solid Solutions of Gold-Silver-Copper in an Antique Object. (In French.) Adrienne R. Weill. *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences,* v. 232, Feb. 12, 1951, p. 630-632.

An Egyptian antique was analyzed by two nondestructive methods: X-ray diffraction and density measurements. The absence of alloy formation and some indications regarding technique of fabrication were shown. The alloy contained 69% Au, 28% Ag, and 2.3% Cu. (M22, M23, Au)

141-M. The Structure of the Carbide System TiC-TaC-WC. (In German.) H. Nowotny, R. Kieffer, and O. Knotek. *Berg-und Hüttenmännische Monatshefte,* v. 96, Jan. 1951, p. 6-8.

Metallographic and X-ray studies at 1450 and 2200° reveal an extensive homogeneous field of (Ti, Ta, W)C solid solution and a heterogeneous field composed of this saturated solid solution and practically pure WC. Method of producing the specimens and experimental procedure. Includes tables, ternary diagrams, and photomicrographs. (M24, C-n, Ti, Ta, W)

142-M. Dependence of Mechanical Properties on the Structure of Two-Phase Alloys. (In German.) H. Unckel. *Metall,* v. 5, Apr. 1951, p. 146-150.

Metallographic studies with steels, brasses, Al-Si, Zn-Sb, Cu-W, and Cu-graphite sintered metals showed that hardness, yield point, tensile and compression strength decrease with increasing distance between the cementite laminae, thickness of ferrite layers, thickness of α layers, grain size of matrix, and graphite content; but increase with increasing W content. Includes photomicrographs, tables, and graphs. (M27, Q general)

143-M. Investigations of the Titanium-Antimony System. (In German.) H. Nowotny and J. Pesl. *Monatshefte für Chemie und verwandte Teile anderer Wissenschaften,* v. 82, Apr. 15, 1951, p. 336-343.

Ti-Sb alloys containing up to 60% Ti were investigated by X-ray, structural, and thermal analysis. Results show the almost complete insolubility of Ti in Sb and the existence of $TiSb_2$, TiSb, and at least one additional phase richer in Ti. Crystal structures of $TiSb_2$ and TiSb and the two phases were explained with respect to neighboring phases of similar structure. 10 ref. (M24, Ti, Sb)

144-M. Investigations of the Titanium-Lead System. (In German.) H. Nowotny and J. Pesl. *Monatshefte für Chemie und verwandte Teile anderer Wissenschaften,* v. 82, Apr. 15, 1951, p. 344-347.

Results of X-ray and metallographic studies of Ti-Pb alloys containing up to 62.5% Ti. X-rays indicate a phase whose composition may be Ti_4Pb. (M24, Ti, Pb)

145-M. (Book) **Tables for Conversion of X-Ray Diffraction Angles to Interplanar Spacing.** 159 pages 1950. National Bureau of Standards, Washington, D. C. (Applied Mathematics Series 10.) (For sale by U. S. Gov't. Printing Office, Washington, D. C.)

Eight tables give spacing values in A.U. corresponding to the angles which are usually measured when diffraction patterns are used for chemical identification and crystal structure determination. The first six tables give spacing values for angles 0-90° at intervals of 0.01°. These tables were calculated using the $K\alpha_1$ radiation for X-ray targets of Mo, Cu, Ni, Co, Fe, and Cr. The last two tables contain a rearrangement of the data for Cu and Fe. (M22, Mo, Cu, Ni, Co, Fe, Cr)

N

TRANSFORMATIONS AND RESULTING STRUCTURES

100-N. Molybdenum Corrects Temper Embrittlement From Phosphorus. Julius J. Harwood. *Steel,* v. 128, Apr. 23, 1951, p. 78.

Effect of Mo on transition temperatures of AISI-SAE 1340 and SAE 5140 steels. (N8, AY)

101-N. Theory of D_0 for Atomic Diffusion in Metals. Clarence Zener. *Journal of Applied Physics,* v. 22, Apr. 1951, p. 372-375.

Theory of the entropy of activation ΔS for interstitial diffusion in metals is extended to self and to chemical diffusion. 18 ref. (N1)

102-N. The Titanium-Hydrogen System and Titanium Hydride. II. Studies at High Pressure. Thomas R. P. Gibb, Jr., James J. McSharry, and Robert W. Bragdon. *Journal of the American Chemical Society,* v. 73, Apr. 1951, p. 1751-1755.

Equilibrium pressure of H_2 over the metallic Ti-H_2 system was measured as a function of content of the solid phase. Measurements were made over the range 175-1000° C. at pressures up to 5000 cm. Results are plotted as log P vs. reciprocal of absolute temperature. A family of isotherms shows plateaus at composition approaching TiH_2, indicating presence of a novel phase. 11 ref. (N12, Ti)

103-N. They're Running Down Gases in Steel. W. A. Peifer. *Steel Horizons,* v. 13, Spring 1951, p. 20-22.

Illustrated review of research on hydrogen in steel, its causes and prevention. (N1, EG-m, ST)

104-N. Preferred Orientation in Zirconium. R. K. McGeary and B. Lustman. *U. S. Atomic Energy Commission,* AECD-2951, Mar. 10, 1950, 24 pages.

Investigated under the following treatments: various types of cold rolling, cross rolling, hot rolling, recrystallization below the transformation temperature, and heating above the transformation temperature. 18 ref. (N5, Q24, Zr)

105-N. A Theory of the Transformation in Pure Cobalt. J. W. Christian. *Proceedings of the Royal Society,* v. 206, Mar. 22, 1951, p. 51-64.

The suggestion that faults in hexagonal Co are in thermal equilibrium with the structure and that the phase change in pure Co is influenced considerably by surface energy is examined. Shows that for the pseudo-equilibrium of a number of individual crystals, surface-energy effects could produce transformation over a temperature range; but other effects of the transformation are not explained. Quantitative results for hexagonal faults show that these cannot be in thermal equilibrium. Shows that the transformation in Co is martensitic in nature. The mechanism is considered in terms of "half dislocations" of the face-centered cubic lattice. 18 ref. (N9, Co)

106-N. Influence of Rate of Cooling After Homogenization on Kinetics of the Decomposition of Supersaturated Solid Solutions of Magnesium and of Silicon in Aluminum. (In French.) H. Jolivet and M. Armand. *Revue de Métallurgie,* v. 48, Feb. 1951, p. 91-96.

The kinetics of decomposition of these solid solutions is dependent upon the rate of cooling after homogenization. Precipitation at a rapid rate of cooling is assisted considerably by previous cold working. The influence of cold working on rate

of precipitation is also more important than previous formation of a precipitated phase during slow cooling. (N7, Al)

107-N. Microradioanalytical Methods in the Study of the Diffusion of Copper into Aluminum in the Presence of Calcium. (In French.) Mladen Paic. *Revue de Métallurgie*, v. 48, Feb. 1951, p. 116-120.

Influence of Ca on the diffusion of Cu into Al plating on Al-Cu-Mg alloys. (N1, Al, Cu)

108-N. On the Behavior of Enormously Large Internal Stress Accompanying the Transformation of a Substance. (In English.) Kotaro Honda. *Science Reports of the Research Institutes, Tohoku University*, ser. A, v. 1, May 1949, p. 1-6.

As an example, the A_3 transformation of Fe is discussed theoretically. Application to pure Fe, and to Fe-Ni and Fe-Mn alloys. (N8, Fe)

109-N. On the Mechanism of the Formation of Pearlite in Steels. (In English.) Kotaro Honda. *Science Reports of the Research Institutes, Tohoku University*, ser. A, v. 1, May 1949, p. 7.

(N8, ST)

110-N. On $\gamma \rightleftarrows \alpha$ Transformation in Fe-Ni Alloys by Supercooling or Superheating. (In English.) Sakae Takeuchi. *Science Reports of the Research Institutes, Tohoku University*, ser. A, v. 1, May 1949, p. 43-49.

Studied for alloys containing 10, 18, 25, and 27% Ni. (N8, Fe)

111-N. On the Velocity of Decomposition of Cementite. (In English.) Hiroshi Yoshisaki. *Science Reports of the Research Institutes, Tohoku University*, ser. A, v. 1, May 1949, p. 63-70.

Results of experimental investigation of the above, as it occurs during conversion of white to gray iron. (N8, CI)

112-N. On the Theory of the Formation of Ferromagnetic Superlattice Alloys. (In English.) Hiroshi Sato. *Science Reports of the Research Institutes, Tohoku University*, ser. A, v. 1, May 1949, p. 71-82.

Statistical mathematical treatment. Includes application to the antiferromagnetic case. 16 ref. (N10, P16, SG-n, p)

113-N. "Temperature Interval" of Lattice Transformation. I. (In English.) Sakae Takeuchi and Hideji Suzuki. *Science Reports of the Research Institutes, Tohoku University*, ser. A, v. 2, Feb. 1950, p. 43-49.

An attempt was made to explain the effects of retained austenite on lattice transformation in Fe-C and Fe-Ni alloys. (N8, Fe, ST)

114-N. Vibration of Liquid Mg-Al Alloys. *Metal Progress*, v. 59, Apr. 1951, p. 560. (Translated and condensed from "The Effect of Sonic and Ultrasonic Vibrations on the Structure of Magnesium-Aluminum Alloys With 4 to 12% Al", Charlotte Siebers and Walter Bulian.)

Previously abstracted from *Metallforschung*. See item 4d-55, 1948. (N12, Mg, Al)

115-N. Producing Single Crystals of Metal. M. A. Steinberg. *Journal of Metals*, v. 3, May 1951, p. 387-388.

Methods used by Horizons, Inc., Cleveland: growth of a crystal from a single nucleus of a new phase; and growth of an existing grain of a polycrystalline specimen to a single crystal through a temperature gradient without recourse to nucleation of a new phase or recrystallization. (N12)

116-N. Isothermal Transformation Characteristics on Direct Cooling of Alloyed White Iron. F. B. Rote, G. A. Conger, and K. A. DeLonge. *American Foundrymen's Society*, Preprint 51-9, Apr. 1951, 13 pages.

Investigation on white iron containing 3.40 C, 1.15 Si, 0.35 Mn, 4.50 Ni, 1.85 Cr, and 0.12 Mo. A complete T-T-T diagram was determined from data obtained by hardness tests and microscopic examinations of wedge-shaped castings, directly air-cooled from the mold to subeutectoid temperatures for isothermal transformation. (N8, CI)

117-N. Mechanism of Crystal Growth. A. G. Smekal. "The Physics of Powder Metallurgy", Ed. 1 (McGraw-Hill, New York), 1951, p. 27-38; disc. p. 38-39.

Since only noncrystallographic growth was found in the recrystallization of metals, the experiments were done on NaCl as a model substance because of its similar behavior to metals. The self-diffusion mechanisms of NaCl were revealed by the behavior of its ionic conductivity. Transparency of the material allowed detection of new grain growth, first at diameters of about 5 microns, and allowed the measurement of rates of growth and induction periods very accurately and reproducibly. In the recrystallization of sintered-powder compacts of NaCl, single crystals in which voids develop into hollow cubes were obtained. Concludes that the actual densification of polycrystalline materials requires assistance of elastic stresses which are always present in polycrystalline specimens. 15 ref. (N3, N5)

118-N. Orientation in Recrystallization and Grain Growth. P. A. Beck. "The Physics of Powder Metallurgy", Ed. 1 (McGraw-Hill, New York), 1951, p. 40-50; disc. p. 50-51.

Shows that orientation relationships found in recrystallization and coarsening of Cu and Al structures, approaching a single orientation, result from orientation dependence of rate of growth. Recrystallization textures in deformed polycrystalline metals with more complicated deformation textures can often be interpreted in terms of the same orientation relationships. The relationships leave open the basic physical question: Why does rate of growth depend on relative orientation of growing grain and matrix? 15 ref. (N3, N5)

119-N. Recrystallization. Marian Balicki. "The Physics of Powder Metallurgy", Ed. 1 (McGraw-Hill, New York), 1951, p. 52-75. disc. p. 75-76.

It was demonstrated in 1936 that the main stage of reannealing of work hardened metals, i.e., recrystallization, can be accounted for quantitatively. Accuracy of the treatment is believed to be sufficient for all practical purposes. Report summarizes the approach and contains an extension of the theory. (N5)

120-N. Self-Diffusion in Iron. F. S. Buffington, I. D. Bakalar, and Morris Cohen. "The Physics of Powder Metallurgy", Ed. 1 (McGraw-Hill, New York), 1951, p. 92-107; disc. p. 107-108.

Some of the techniques that have been used for self-diffusion measurements, and results of an original investigation of self-diffusion in pure Fe. Radioactive tracers have proved to be a most valuable tool for such studies. 15 ref. (N1, Fe)

121-N. Homogeneous Nucleation. David Turnbull and J. H. Hollomon. "The Physics of Powder Metallurgy", Ed. 1 (McGraw-Hill, New York), 1951, p. 109-140; disc. p. 141-142.

Nucleation of a new phase appears to be quite unrelated to sintering of metal powder. However, kinetics of the two processes appears to be largely controlled by the same physical constants: surface energy and diffusion coefficients. Theory of homogeneous nucleation; nature of nucleation catalysis; methods for experimental confirmation of theory; liquid-solid, solid-vapor, and solid-solid transformations; and transformations without composition change. 46 ref. (N2, H15)

122-N. Relations Between Diffusion and Viscous Flow in Metals. B. H. Alexander, G. C. Kuczynski, and M. H. Dawson. "The Physics of Powder Metallurgy", Ed. 1 (McGraw-Hill, New York), 1951, p. 202-213; disc. p. 213.

Discussion on the basis of the literature, reviewing both theoretical and experimental work. Work using gold wires to obtain strain-time plots. 11 ref. (N1, Q24, Au)

123-N. The Application of Hydrogen Equilibrium-Pressure Measurements to the Investigation of Titanium Alloys Systems. A. D. McQuillan. *Journal of the Institute of Metals*, v. 79, Apr. 1951, p. 73-88.

A method for investigation of equilibrium relations in certain alloy systems, which depends on measurement of H_2 pressures in equilibrium with a very dilute solution of H_2 in the alloys. The method is illustrated by a theoretical treatment of a hypothetical, simplified system, and is then applied to a series of alloys in a limited region of the Ti-Cu and Ti-Fe systems. It was found that both Cu and Fe depress the $\alpha \rightleftarrows \beta$ transformation in Ti. Effect of these elements on solubility of H_2 in Ti-rich β-solid solution. (N6, M24, Ti)

124-N. Joint Discussion on the Papers: "The Overheating and Burning of Steel. Part III. The Influence of Excessive Reheating Temperatures on the Mechanical Properties and the Structure of Alloy Steels", A. Preece, J. Nutting, and A. Hartley; "The Detection of Overheating and Burning in Steel by Microscopical Methods," A. Preece and J. Nutting: "Grain-Boundary Phenomena in Severely Heated Steel," T. Ko and D. Hanson; and "A Note on the Overheating of Steels," E. C. Rollason and D. F. T. Roberts. *Journal of the Iron and Steel Institute*, v. 167, Apr. 1951, p. 367-372. (N8, N12, M21, Q general, ST)

125-N. Discussion on the Paper: "The Extension of the Ar_1 Range With Carbide Formation in Mild Steel Due to High-Temperature Treatment," J. H. Whitely. *Journal of the Iron and Steel Institute*, v. 167, Apr. 1951, p. 372-374.

(N8, CN)

126-N. Reactions Induced by Cold Hardening and Annealing of Low-Carbon 18-8 Steels. (In French.) P. Bastien and J. Dedieu. *Métaux & Corrosion*, v. 25, Dec. 1950, p. 308-311.

A series of stainless steels with different Ni content (4-12%) was studied. It was found that a difference of only 1% Ni results in the change from an unstable to an almost completely stable state, the amount of other components and condition of treatment being the same. Experimental investigation of two specimens, one stable (10% Ni), the other unstable (9% Ni), showed the possibility of causing the $\gamma \rightarrow \alpha$ transformation to take place at room temperature by cold hardening and formation of a sigma phase by annealing. (N8, J23, J26, SS)

127-N. Thermomagnetic Study of Iron and Nickel Carbides. (In French.) Roger Bernier. *Annales de Chimie*, v. 6, Jan.-Feb. 1951, p. 104-159.

Investigation of structure, mechanism of formation, properties, behavior of cementite and related carbides, depending on temperature, and a thorough analysis of the Fe-Ni-C ternary system. Technique of investigation is described, data and results. 66 ref.

(N8, M24, Fe, Ni, C-n)

128-N. Transformations in the Range of the Ternary α-Au-Cu-Zn Solid Solutions. (In German.) Ernst Raub and Paul Walter. *Zeitschrift für Metallkunde*, v. 41, Nov. 1950, p. 425-433.

Studied by micrographic, thermal-resistance, and X-ray methods for 25 alloys containing 15-25% Au, 43-72% Cu, and 3.4-42.0% Zn. (N6, Au, Cu, Zn)

129-N. Transformation of Austenite in a Manganese-Molybdenum Steel Deposited as Weld Metal. Hallock C. Campbell. *Welding Journal,* v. 30, May 1951, p. 253s-254s.

Discusses above paper by O. O. Miller, F. C. Kristufek, and R. H. Aborn. (Sept. 1950 issue; see item 192-N, 1950.) (N8, AY)

130-N. Grain Boundary Diffusion in Metals. A. D. LeClaire. *Philosophical Magazine,* ser. 7, v. 42, May 1951, p. 468-474.

An expression is derived relating the diffusion coefficients for grain boundary and for volume diffusion, effective "width" of the grain boundary, and angle at a certain time between a line of constant concentration and the grain boundary at the point where it meets the grain boundary. Relation of other work on grain boundaries to grain-boundary diffusion. Suggests that activation energies for grain boundary and for volume diffusion may not differ appreciably. 13 ref. (N1)

131-N. Theories on the Age-Hardening of Metallic Alloys. (In German.) F. Rohner. *Berg-und Hüttenmännische Monatshefte,* v. 96, Feb. 1951, p. 21-25.

Theories are numerous and often conflicting. The great difficulty in investigating this problem lies in our incomplete knowledge of the relationship of mechanical and physical properties to atomic structure of alloys. 40 ref. (N7)

132-N. The Segregation Process in Copper-Beryllium Alloys. (In German.) W. Gruhl and G. Wassermann. *Metall,* v. 5, Mar. 1951, p. 93-98; Apr. 1951, p. 141-145.

Experiments made to study segregation in an alloy containing 1.82% Be by measuring changes in electrical resistance and by microscopic and X-ray studies. The effect of cold working directly after quenching on the segregation of the various phases was also investigated. Phase diagrams, graphs, X-ray pictures and photomicrographs. 26 ref. (N12, N7, Cu)

P

PHYSICAL PROPERTIES AND TEST METHODS

147-P. Sintered Nickel Steels. F. Benesovsky. *Powder Metallurgy Bulletin,* v. 6, Apr. 1951, p. 18-21.

Density, hardness, tensile strength, elongation, and structure of the sintered steels 2-14% Ni and 0-0.7% C. (P10, Q27, Q29, M27, AY)

148-P. High Temperature Structure and Thermal Expansion of Some Metals as Determined by X-Ray Diffraction Data. I. Platinum, Tantalum, Niobium, and Molybdenum. James W. Edwards, Rudolph Speiser, and Herrick L. Johnston. *Journal of Applied Physics,* v. 22, Apr. 1951, p. 424-428.

Determined between 1100 and 2500° K. Quadratic equations were developed for the thermal expansion. Values of the expansion coefficient α were computed for each of the metals, and compared with those obtained from the Groeneisen theory. 17 ref.
(P11, M22, Pt, Ta, Cb, Mo)

149-P. Interfacial Free Energy of Coherent Twin Boundaries in Copper. R. L. Fullman. *Journal of Applied Physics,* v. 22, Apr. 1951, p. 448-455.

The ratio of the above to the average grainboundary free energy in Cu was measured by means of the dihedral angles formed at the intersections of twin boundaries and grain boundaries with each other and with a Cu-Pb vapor interface. 12 ref. (P12, M27, Cu)

150-P. Crystallography and Interfacial Free Energy of Noncoherent Twin Boundaries in Copper. R. L. Fullman. *Journal of Applied Physics,* v. 22, Apr. 1951, p. 456-460.

It was found that the noncoherent twin boundary is approximately parallel to a (113) plane of one crystal and to a (335) plane of the other. The ratio of the interfacial free energy of noncoherent twin boundaries to average grain-boundary free energy in Cu was found to be 0.80: 0.015. Two measurements by a second method confirm this value.
(P12, M26, Cu)

151-P. Coefficients of Thermal Expansion of Au-Cd Alloy Containing 47.5 Atomic Percent Cd. Lo-Ching Chang. *Journal of Applied Physics,* v. 22, Apr. 1951, p. 525-526.

The X-ray single-crystal oscillation method is used. Experimental procedures, calculations, and results. (P11, Au, Cd)

152-P. The Heat of Combustion of Magnesium and Aluminum. Charles E. Holley, Jr., and Elmer J. Huber, Jr. *U. S. Atomic Energy Commission,* AECU-1172, Apr. 5, 1951, 10 pages.

Precise measurements using an oxygen bomb colorimeter of standard design. Comparison of results with those of other investigators.
(P12, Al, Mg)

153-P. An Absolute Measurement of the Susceptibility of Tantalum and Other Metals. F. E. Hoare and J. C. Walling. *Proceedings of the Physical Society,* v. 64, sec. B, Apr. 1, 1951, p. 337-341.

Magnetic susceptibility of Ta was determined absolutely. Small specimens were used to determine, by a comparative method, the susceptibilities of specimens of Pt, Pd, and Rh at 20° C. 11 ref.
(P16, Ta, Pt, Pd, Rh)

154-P. Adsorption on Evaporated Tungsten Films. II. The Chemisorption of Hydrogen and the Catalytic Parahydrogen Conversion. B. M. W. Trapnell. *Proceedings of the Royal Society,* v. 206, Mar. 22, 1951, p. 39-50.

Chemisorption of H_2 in densely packed layers on tungsten is shown to be reversible even at liquid-air temperatures. Values for fraction of surface atoms covered were obtained for various temperatures and pressures; combination of isothermal heats for high values of this fraction with previously published calorimetric heats for low values gives the heat curve for the whole range of chemisorption. Results are applied to kinetics of the parahydrogen conversion. 16 ref. (P13, W)

155-P. Some Experimental Measurements of the Inner Potentials of Various Crystals. V. F. G. Tull. *Proceedings of the Royal Society,* ser. A, v. 206, Apr. 10, 1951, p. 219-232.

Inconsistencies among previously reported measurements and their possible causes. New experiments in which no difference was found in results obtained from different surfaces of the same crystal. Measurements were also made, using fast electrons, of the inner potentials of metal crystals, and it was found that consistent results could be obtained in all cases if suitable experimental precautions were observed. It was also found that presence of a thin contaminating surface layer did not affect the results, provided the electron beam was able to penetrate the first few atomic layers of the specimen. 15 ref.
(P15, M25)

156-P. The Calculation of the Inner Potential of a Crystal. V. F. G. Tull. *Proceedings of the Royal Society,* ser. A, v. 206, Apr. 10, 1951, p. 232-241.

Although a number of calculations of inner potential have been made for various crystals, the results have been rather inconsistent. Shows that electron-distribution charts and curves obtained experimentally are not suitable for calculation of inner potential; an exponential approximation for atomic scattering factors is found to be more reliable for this purpose. A simple modification of the electron-distribution curves is obtained from these atomic-scattering factors. Results of a number of calculations based on this method compared with experimental values for metallic and nonmetallic crystals. 11 ref. (P15, M25)

157-P. Is Hooke's Law a Limiting Law? (In French.) Adrien Jaquerod. *Revue de Métallurgie,* v. 48, Feb. 1951, p. 85-90.

Experimental investigation indicates that flexion oscillations of metals and alloys are never isochronous even at an amplitude as low as 0.5°. Similar deviations from Hooke's law were previously observed in a series of experiments based on torsion oscillations. (P21)

158-P. Electrical Properties of Gray Tin. (In German.) G. Busch, J. Wieland, and H. Zoller. *Helvetica Physica Acta,* v. 24, Feb. 15, 1951, p. 49-62.

Gray tin of high purity was prepared by prolonged cooling of spectroscopically pure metallic tin, and numerous alloys were made by adding small amounts of Al. Conductivity was determined by measuring the Q-factor of a coil containing a core of gray tin powder at frequencies up to 30 mc. per ssc. Hall effect and change of resistivity in a magnetic field were measured by conventional d.c. methods. The experiments show that gray Sn is a semiconductor of high electrical conductivity, with properties similar to those of Si and Ge. 19 ref. (P15, Sn)

159-P. Research on the Recovery of Electrical Resistance and the Thermoelectric Force of Commercial Cu Wires. (In German.) Kurt Lücke. *Zeitschrift für Metallkunde,* v. 42, Jan. 1951, p. 1-10.

Highly accurate method of measuring the effect of temperature and degree of drawing on the specific electrical resistance of different commercial Cu wires after thermal and electrical treatment. Results prove the validity of Matthiessen's rule. A difference in the recovery isotherms for resistance and for thermoelectric force was noted.
(P15, Cu)

160-P. Development of Electrical Potentials of Zinc-Aluminum Alloys in Acid Electrolytes. (In German.) Georg Masing and Gisela Moldehnke-Hohmann. *Zeitschrift für Metallkunde,* v. 42, Jan. 1951, p. 19-23.

Effect of pure Al on the Zn potential in acid 0.5 *N* NaCl solutions. Changes in potentials of pure Zn and pure Al, as well as the fact that the potential of a mechanical mixture is determined by the nobler component, are explained by the very strong polarizability of Zn-rich solid solution. O_2 in the electrolyte was found to greatly reduce the polarizability of the electrode.
(P15, R1, Zn)

161-P. Observations on Liquid Contact Bridges. (In German.) Gerhard Schrag and Horst Steinert. *Zeitschrift für Metallkunde,* v. 42, Jan. 1951, p. 24-26.

Experiments made to study further the formation of molten metal or metal-oxide bridges upon the opening of contacts. Data for Ni contacts are tabulated, charted, and discussed. (P15, Ni)

162-P. The Great Barkhausen Effect. Part III. Growth and Disappearance of the Remagnetization Nucleus. (In German.) Shiro Ogawa. *Science Reports of the Research Institutes,*

Tohoku University, ser. A, v. 1, May 1949, p. 53-61.

Remagnetization nuclei of an alloy wire (30% Fe, 45% Ni, 25% Co) were formed at different field strengths and their dimensions measured. Doering's diagram explains their growth and disappearance with increase and decrease of the field. Includes diagrams and graphs. (P16, SG-n)

163-P. On the Change of Reversible Susceptibility of Ferromagnetic Substances Due to Tension. (In English.) Tatsuya Katayama and Nobuhiko Kunitomi. *Science Reports of the Research Institutes, Tohoku University,* ser. A, v. 2, Feb. 1950, p. 22-28.

According to the internal-stress theory of ferromagnetic substances given by Kersten and Döring, the authors calculated reversible susceptibility as a function of magnetization under various applied tensions. Theoretical reversible susceptibility thus obtained is constant at an early stage of magnetization and decreases rapidly just before magnetic saturation. But, if internal stress is larger than applied stress, it has a maximum before a sudden decrease, which occurs near magnetic saturation. These theoretical results explain experimental data qualitatively but some quantitative differences were found.
(P16, SG-n, p)

164-P. Anelasticity of Ferromagnetics: Magneto-Elastic Relaxation in Nickel. (In English.) Taira Suzuki and Mikio Yamamoto. *Science Reports of the Research Institutes, Tohoku University,* ser. A, v. 2, Feb. 1950, p. 68-80.

Concerned with the relation between Bloch walls and structural imperfections in ferromagnetics, both of which are movable under an applied stress. Experimental results are discussed somewhat quantitatively from the point of view of the recent theory of the boundary layer model of mosaic structures in metals in connection with ferromagnetic domain structures.
(P16, Ni, SG-n, p)

165-P. On the Electromagnetic Properties of Single Crystals of Tellurium. II. Ettingshausen-Nernst Effect. III, Adiabatic and Isothermal Hall Effect, and Ettingshausen Effect. (In English.) Tadao Fukuroi, Seiichi Tanuma, and Shotaro Tobisawa. *Science Reports of the Research Institutes, Tohoku University,* ser. A, v. 2, Apr. 1950, p. 233-248.

Part II: The Ettingshausen-Nernst effect was measured from −160 to 300° C. In the intrinsic semiconductor range, it was found that coefficient of this effect is roughly in agreement with that evaluated theoretically from values of electron and hole mobilities and width of the forbidden region, which was deduced from experimental values of conductivity, Hall coefficient, and magneto-resistance coefficient measured on the same specimen. Part III: a study of adiabatic and isothermal Hall effects from −180 to 350° C. (P16, Te)

166-P. Reduction Equilibria of Iron Oxides. II. Measurement of the Equilibrium of the Reaction, FeO (I) + CO = Fe(s) + CO_2. (In English.) Koji Sanbongi. *Science Reports of the Research Institutes, Tohoku University,* ser. A, v. 2, Apr. 1950, p. 296-304.

Apparatus and results. 12 ref.
(P12, D general, Fe)

167-P. Fundamental Researches on Smelting of Sulphide Ores. I. Experimental Apparatus and Method of Measurement. II. On the Equilibrium in the Reduction of Solid Ferrous Sulphide by Hydrogen Gas. III. On the Equilibrium in the Reduction of Solid Silver Sulphide by Hydrogen Gas. IV. On the Equilibrium in the Reduction of Solid Lead Sulphide by Hydrogen Gas. (In English.) Kingo Sudo. *Science Reports of the Research Institutes, Tohoku University,* ser. A, v. 2, Apr. 1950, p. 305-330.

46 references.
(P12, D general, C general, Fe, Ag, Pb)

168-P. The Change of the Electric Resistance of Bismuth Crystals in Strong Magnetic Fields. Part III. Experimental Results. (2). The Change of Resistance of Bismuth Crystals in a Magnetic Field With the Current Parallel and Being Inclined to the Direction of the Lines of Force of the Magnetic Field. (In English.) Yasaku Tanabe. *Science Reports of the Research Institutes, Tohoku University,* ser. A, v. 2, Apr. 1950, p. 341-351.
(P15, Bi)

169-P. High Saturation Magnetic Alloy With a Rectangular Hysteresis Loop. J. F. Libsch and Eberhard Both. *Electrical Engineering,* v. 70, May 1951, p. 420-421.

A study was made of magnetic alloys which have approximately rectangular loops. This characteristic is desirable for materials used in saturable reactors, magnetic amplifiers, pulse transformers, and other nonlinear circuit elements.
(P16, SG-p)

170-P. Thermodynamics of Iron-Silicate Slags; Slags Saturated With Gamma Iron. R. Schuhmann, Jr. and P. J. Ensio. *Journal of Metals,* v. 3, May 1951; *Transactions of the American Institute of Mining and Metallurgical Engineers,* v. 191, 1951, p. 401-411.

As a first step in a study of the physical chemistry of Cu smelting slags, experimental measurements were made of the O_2 pressure of simple iron-silicate slags in equilibrium with solid Fe. The experiments consisted in bubbling CO_2-CO mixtures through the slags in Fe crucibles and in finding the equilibrium ratios of CO_2 to CO. From the data, activities and partial molal heats of solution of FeO and SiO_2 in the slags were calculated. 15 ref.
(P12, B21, Fe, Cu)

171-P. Physical and Mechanical Properties of Pure Nickel. *Nickel Bulletin,* v. 24, Jan. 1951, p. 2-5.

A tabular summary covering both high-purity and commercial Ni.
(P general, Q general, Ni)

172-P. Distribution of Energy Loss of Electrons in Aluminum. R. D. Birkhoff. *Physical Review,* ser. 2, v. 82, May 1, 1951, p. 448-449.

Conversion electrons of Ba^{137} were examined before and after passing through a thin foil of Al by means of a beta-spectrograph. (P15, Al)

173-P. Collective Electron Ferromagnetism: Rectangular Energy Bands. E. P. Wohlfarth. *Philosophical Magazine,* ser. 7, v. 42, Apr. 1951, p. 374-390.

Calculations similar to those of Stoner were carried out for an energy band for which the energy density of states is constant. Relations are derived giving dependence on temperature and interchange interaction energy of spontaneous magnetization below, and susceptibility above, the Curie point. Experimental results on magnetic properties of Ni and its alloys and on thermal properties of Ni, including energy and specific heat characteristics, temperature variation of specific heat, and magneto-caloric effect. The high-temperature specific heat of paramagnetics. 16 ref.
(P16, Ni, SG-n, p)

174-P. The Resistance-Minimum in Gold. D. K. C. MacDonald and I. M. Templeton. *Philosophical Magazine,* ser. 7, v. 42, Apr. 1951, p. 432-434.

The above phenomenon, which appears at very low temperatures, was investigated for pure specimens and for alloys containing 0.05% Cu, 0.05% Ni, or 0.2% Ni. Method of annealing was investigated as a possible variable. (P15, Au)

175-P. Surface Tension of Liquid Metals. D. V. Atterton and T. P. Hoar. *Nature,* v. 167, Apr. 14, 1951, p. 602.

Available experimental values of surface tension are plotted vs. reciprocals of the corresponding atomic volumes. Diagram shows that surface tension is approximately inversely proportional to atomic volume, and that the relationship holds for metals of such widely different types as Na, Bi, and Fe. (P10)

176-P. Volume Changes of an Al-Cu Alloy During the Individual Stages of Segregation. (In German.) Johann Christian Kankes and Günther Wassermann. *Zeitschrift für Metallkunde,* v. 41, Nov. 1950, p. 381-391.

Procedure for measuring linear changes as small as 0.005%. Results for Al alloy containing 4.08% Cu indicate that aging at temperatures up to 100° C. will contract the material; between 100 and 260° C., the material expands, but again contracts above 260° C. Activation energy of the segregation process; comparative hardness tests; effect of reversed re-formation at lower temperatures. 28 ref. (P10, Al)

177-P. The Behavior of Zn in Acid Electrolytes. (In German.) Georg Masing and Gisela Moldehnke. *Zeitschrift für Metallkunde,* v. 41, Nov. 1950, p. 406-412.

Results of experiments indicate that Zn potential should be regarded as a composite potential of the Zn anode and the H_2 cathode. Brief tests with NaCl and Na_2SO_4 solutions saturated with air and free from air, but without Zn ions, show that potential depends on acidity of the electrolyte. Various factors affecting the behavior of Zn were investigated. 13 ref. (P15, Zn)

178-P. Kinetics of Changes of Energy Anisotropy During Superlattice Formation. (In Russian.) N. S. Akulov and E. P. Svirina. *Doklady Akademii Nauk SSSR* (Reports of the Academy of Sciences of the USSR), new ser., v. 76, Feb. 11, 1951, p. 669-671.

Dependence of the constant of energy anisotropy in high-permeability alloys of the $FeNi_3$ type on degree of order. Curves of dependence of this constant on time of the isothermal process for different temperatures. (P16, N10, Fe, Ni)

179-P. The Melting Point-Composition Diagram of the Zirconium-Oxygen System. Daniel Cubicciotti. *Journal of the American Chemical Society,* v. 73, May 1951, p. 2032-2035.

Solidus curve of the Zr-ZrO_2 system was investigated by observing the melting points of wires of the oxidized metal. Results show that near the melting points O_2 dissolves to the extent of 55 at. % in solid Zr metals, while Zr dissolves in the solid dioxide to form a 15 mole % solution. No evidence found for compounds other than the dioxide. 16 ref. (P12, M24, Zr)

180-P. The Heats of Combustion and Formation of Titanium Nitride (TiN) and Titanium Carbide (TiC). George L. Humphrey. *Journal of the American Chemical Society,* v. 73, May 1951, p. 2261-2263.

Determined by burning the materials in a bomb containing O_2. Standard heats of formation were calculated from combustion data. Free energies of formation are also listed. 15 ref. (P12, Ti, C-n)

181-P. The Electrochemical Behavior of Aluminum. II. In Solutions of Iron Sulfate. J. V. Petrocelli. *Journal of the Electrochemical Society,* v. 98, May 1951, p. 183-186.

The reactivity of pure Al with Fe sulfate in solutions of varying acid strength. Electrode potentials, weight-loss data, and polarization curves show that the reaction may

be interpreted from an electrochemical point of view. (P15, Al)

182-P. Varioperm Alloys With Temperature-Dependent Permeability. *Microtecnic* (English Ed.), v. 5, Jan.-Feb. 1951, p. 24-25.

Composition of these Fe-Ni alloys is such that their Curie point is in the vicinity of the ambient temperature; increased temperature brings about a marked reduction of permeability. They are made by a Swiss firm. Properties and applications are briefly outlined. (P16, Fe, Ni)

183-P. Light Refraction Functions of Thin Multiple Layers and Their Applications. (In German.) Hubert Schröder. *Zeitschrift für angewandte Physik*, v. 3, Feb. 20, 1951, p. 53-66.

Mathematical treatise demonstrates the capacity and amplifying effect of multilayer systems. Application to various problems of light refraction. The procedure can be applied to absorbing layers, and it is a convenient method of determining, from intensity measurements, the optical constants of metals. 60 ref. (P17)

Q

MECHANICAL PROPERTIES AND TEST METHODS; DEFORMATION

241-Q. Formulas for the Determination of Residual Stress in Wires by the Layer Removal Method. W. T. Read, Jr. *Journal of Applied Physics*, v. 22, Apr. 1951, p. 415-416.

The distribution of residual axial stress in a beam or wire of circular cross section is derived as a function of the moment required to straighten the wire after removal of successive layers of material. Application of the formulas involves two graphical differentiations and integrations of experimental curves. (Q25)

242-Q. The Deformation of Gold Wire at High Temperature. B. H. Alexander, M. H. Dawson, and H. P. Kling. *Journal of Applied Physics*, v. 22, Apr. 1951, p. 439-443.

Gold wires were subjected to small tensile stresses at high temperatures and the strain-time relationship, coefficient viscosity, and surface energy were determined. Theories to explain viscous behavior of metals. (Q24, P10, Au)

243-Q. Improved Tests Evaluate Nodular Iron. W. W. Austin, Jr. *Iron Age*, v. 167, Apr. 19, 1951, p. 86-89.

Physical and mechanical properties of nodular iron obtained from keel-block tensile specimens. Use of the standard ASTM 0.625-in.-diam. malleable test bar. (Q27, P general, CI)

244-Q. Residual Grinding Stresses in Mild Steel. J. Frisch and E. G. Thomsen. *Transactions of the American Society of Mechanical Engineers*, v. 73, Apr. 1951, p. 337-342; disc., p. 342-346.

A method for determining residual surface stresses. It is necessary to remove small layers from the part which has been bent by residual stresses in the unrestrained state and to measure the resulting change in deflection and thickness of metal removed. Etching with a weak HNO_3 solution was found to be a satisfactory method for removing surface metal without introducing additional stresses. Results for mild steel. (Q25, G18, CN)

245-Q. Behavior of Molybdenum and Tungsten in Low and Medium Temperature Ranges. E. Nachtigall. *Powder Metallurgy Bulletin*, v. 6, Apr. 1951, p. 26-31.

Oxidation behavior, hardness, tensile strength, and elongation of Mo and W below 500° C. (Q27, Q29, R2, Mo, W)

246-Q. Brittle Fractures in Welded Bridges. P. R. Bijlaard. *Engineering News-Record*, v. 146, Apr. 26, 1951, p. 46-48.

Several examples with emphasis on fundamental principles. (Q26, T26, CN)

247-Q. Wire Strain in Screen Weaving. R. Traon. *Wire and Wire Products*, v. 26, Apr. 1951, p. 299-301.

Results of an investigation including equations for expressing internal strain and methods of remedying it. (Q25, G6)

248-Q. Some Properties of High-Purity Sintered Wrought Molybdenum Metal at Temperatures Up to 2400° F. R. A. Long, K. C. Dike, and H. R. Bear. *National Advisory Committee for Aeronautics*, Technical Note 2319, Mar. 1951, 75 pages.

Studies were made on tensile strength, stress-rupture properties, types of fracture, directional tensile properties of rolled plate, and metallography of swaged and recrystallized molybdenum. (Q general, M general, Mo)

249-Q. Fatigue Strengths of Aircraft Materials; Axial-Load Fatigue Tests on Unnotched Sheet Specimens of 24S-T3 and 75S-T6 Aluminum Alloys and of SAE 4130 Steel. H. J. Grover, S. M. Bishop, and L. R. Jackson. *National Advisory Committee for Aeronautics*, Technical Note 2324, Mar. 1951, 66 pages.

Experimental investigation included the following: determination of fatigue strengths, in tests at a speed of about 1100 cycles per min., covering a range of mean loads from zero to a high tensile value, and, for each loading condition, lifetimes from 10,000 to 10,000,000 cycles; determination of fatigue strengths in tests at about 90 cycles per min.; several measurements of damage or strengthening at one stress level due to previous loading at another stress level. 17 ref. (Q7, Al, AY)

250-Q. Development of Magnesium-Cerium Forged Alloys for Elevated-Temperature Service. K. Grube, R. Kaiser, L. W. Eastwood, C. M. Schwartz, and H. C. Cross. *National Advisory Committee for Aeronautics*, Technical Note 2325, Mar. 1951, 91 pages.

Investigation included development of improved alloys, and a fundamental study correlating alloy composition and structure with resistance to creep. Nominal composition of the recommended alloy is 1.7% Mn, 2% Ce, 0.25% Ni, and balance Mg. (Q3, M27, Mg)

251-Q. A Mechanical Wear Test Using Fission Fragments. David H. Frisch and Jules S. Levin. *U. S. Atomic Energy Commission*, AECU-1078, Aug. 15, 1950, 4 pages.

Previously abstracted from *ASTM Bulletin*. See item 148-Q, 1951. (Q9, S19)

252-Q. Effects of Temperature Distribution and Elastic Properties of Materials on Gas-Turbine-Disk Stresses. Arthur G. Holms and Richard D. Faldetta. Thirty-Third Annual Report of the National Advisory Committee for Aeronautics, Technical Report 864. 1947. p. 67-73.

Calculated for a wide range of temperatures and centrifugal forces. Materials are not emphasized. Results are plotted. (Q25, Q21)

253-Q. Determination of Elastic Stresses in Gas-Turbine Disks. S. S. Manson. Thirty-Third Annual Report of the National Advisory Committee for Aeronautics, Technical Report 871, 1947, p. 241-251.

Finite-difference solution of the equilibrium and compatibility equations for elastic stresses in a symmetrical disk. Account is taken on point-to-point variations in disk thickness, in temperature, in elastic and in Poisson's ratio. Computations can be performed by nontechnical computers with little engineering supervision. Illustrative examples are presented. Effect of shrink fitting is taken into account. (Q21)

254-Q. The Application of Boltzmann's Superposition Theory of Materials Exhibiting Reversible β Flow. C. Henderson. *Proceedings of the Royal Society*, v. 206, Mar. 22, 1951, p. 72-86.

Boltzmann's theory of superposition is applied to flow and recovery of a material in the so-called anelastic region, in which deformations outside the elastic region are slowly recoverable on removing the stress. Experimental work to test the theory shows that the Andrade creep equation applies not only to large deformation of a completely irreversible character, but in this region also. Formulas are developed which give the amount of creep recovery, and of stress relaxation at constant strain, after any duration of an applied constant stress, for a material which at larger stresses exhibits the Andrade β flow. 10 ref. (Q22)

255-Q. Fracture Under Combined Stress Creep Conditions of 0.5% Mo Steel. A. E. Johnson and N. E. Frost. *Engineer*, v. 191, Apr. 6, 1951, p. 434-437.

Pure tension, pure torsion, and combined stress-creep tests were made at 550° C., to examine the validity of the Siegfried hypothesis of fracture under combined stress-creep conditions, and to establish a criterion of fracture. It was found that the results obtained cannot be explained upon the basis of the Siegfried criterion, and that the criterion of fracture is apparently the maximum principal stress. (Q26, Q3, AY)

256-Q. The Effect of Strain-Hardening on the Equalization of Moments in the Simple Plastic Theory. M. R. Horne. *Welding Research*, v. 5, Feb. 1951, (bound with *Transactions of the Institute of Welding*, v. 14) p. 147r-153r.

Tests have indicated that for mild-steel beams and portal frames, the principle of equalization of moments gives a close estimate of bending-moment distribution at collapse, but no tests have hitherto been made on higher carbon steels. Tests were performed on simply supported beams of varying carbon content and stress-strain curves from these experiments were used for a theoretical investigation of two rectangular-beam problems. A comparison is made between the plastic theory which ignores strain-hardening and that which takes strain-hardening into account. The same problems were also solved for an I-beam by using Hrennikoff's deflection coefficients for mild-steel beams bent beyond the elastic limit. (Q23, CN)

257-Q. Production Problems. III. Fracture Characteristics of Malleable Iron Castings. *Iron and Steel*, v. 24, Apr. 1951, p. 122-123.

In view of the pronounced differences in fracture characteristics of various hinge castings in malleable cast iron and because of the obvious embrittlement associated with certain components, microstructural investigation was completed. (Q26, M27, CI)

258-Q. The Slip, Twinning, Cohesion, Growth, and Boundaries of Crystals. H. Wilman. *Proceedings of the*

Physical Society, v. 64, Apr. 1, 1951, p. 329-350.
Nature and stability of intercrystalline boundaries and conclusions as to preferred relative orientations illustrated by ball-bearing and bubble-raft models. Electron-diffraction evidence from crystals of layer-lattice, ionic, metallic, and van der Waals types shows that crystal pairs and symmetrical or unsymmetrical triplet of multiplet crystal groupings occur, having a common lattice row, but in relative azimuthal orientations at intervals agreeing with the predictions. The seven types of electron diffraction patterns observed, and the nature of the specimen preparation, suggest that origin of these groupings is mechanical deformation of the crystals during or after growth, by a process of "rotational slip". Such slip is demonstrated macroscopically as a deformation process in potassium ferrocyanide trihydrate and gypsum. 92 ref. (Q24, N5)

259-Q. A Surface Effect in the Creep Behaviour of Polycrystalline Lead. E. N. da C. Andrade and A. J. Kennedy. *Proceedings of the Physical Society*, v. 64, sec. B, Apr. 1, 1951, p. 363-366.
Results of some experiments with pure lead containing 0.05% Te. This addition gives a metal which, at room temperature, shows no permanent flow except at the highest stresses. Experiments were made with wires of four different diameters, grain diameter being very nearly the same in each case.
(Q3, Pb)

260-Q. Modifications of the Structure of Aluminum During Creep. (In French.) G. Wyon and Ch. Crussard. *Revue de Métallurgie*, v. 48, Feb. 1951, p. 121-130.
Micrographic studies of intracrystalline structures formed during creep at 250-310° C. revealed several modifications of deformation. Slow-moving boundaries, valley formation on the surface, large angular and net bending, and networks of swelling in the finest grains or near the boundaries of large grains were some of the effects observed. 14 ref.
(Q3, Al)

261-Q. A Theory of Deformation Structures in Metals. (In French.) W. R. Hibbard. *Revue de Métallurgie*, v. 48, Feb. 1951, p. 131-134.
Theory based on stable orientations of monocrystals and on slip and flow effects under a particular strain. 22 ref. (Q24)

262-Q. Transverse Stresses Resulting From Tensile Testing. (In French.) Bernard Jaoul. *Comptes Rendus hebdomadaires des Seances de l'Académie des Sciences*, v. 232, Feb. 5, 1951, p. 477-479.
Investigated for plane and tubular specimens of 99.99% Al. Results are subjected to theoretical analysis.
(Q27, Al)

263-Q. Friction, Lubrication, and Wear; A Review of Publications of the Years 1944 to 1948. (In German.) Robert Kobitzsch. *Erdöl und Kohle*, v. 4, Jan. 1951, p. 9-17.
Covers German and foreign literature. 72 ref. (Q9)

264-Q. Comparison of Mohs' Hardness Scale With Results by Other Hardness Testing Methods. (In German.) Nikolaus Ludwig. *Metalloberfläche*, v. 5, ser. A, Mar. 1951, p. 38-42.
Photomicrographs, graphs, and tables supplement this comparative study of different methods of hardness testing. 23 ref. (Q29)

265-Q. Extruded and Forged Mg Alloys Containing Zirconium. (In German.) F. Sauerwald. *Metall*, v. 5, Mar. 1951, p. 101-103.
Effects of Cd, Zn, and heat treatment, and previous history of the alloys on their extrudability, forgeability, and other mechanical properties. 11 ref. (Q23, F22, F24, Mg)

266-Q. On Young's Modulus of Elasticity of Single Crystals of Nickel and Cobalt. (In English.) Kotaro Honda and Yuki Shirakawa. *Science Reports of the Research Institutes, Tohoku University*, ser. A, v. 1, May 1949, p. 9-15.
New microscopic method for determination of Young's modulus. Results for single crystals of Co and Ni. 14 ref. (Q21, Co, Ni)

267-Q. On Young's Modulus and Its Temperature Coefficient of the Alloys of Cobalt, Iron and Chromium, and a New Alloy "Co-Elinvar". (In English.) Hakaru Masumoto and Kideo Saito. *Science Reports of the Research Institutes, Tohoku University*, ser. A, v. 1, May 1949, p. 17-22.
(Q21, Co, Fe, Cr, SG-n)

268-Q. On the Mechanism of Cold Brittleness in Metals. (In English.) Tomiya Sutoki. *Science Reports of the Research Institutes, Tohoku University*, ser. A, v. 1, May 1949, p. 23-28.
Tensile and Charpy impact tests were made with Flodin iron, 0.3 and 0.7% C steels, Zn, and Al, at temperatures ranging from that of liquid Ni up to about 200° C. Results indicate that the ductile-brittle transformation temperature is not inherent in a particular metal, but is influenced by experimental conditions. 10 ref. (Q23, Fe, CN, Zn, Al)

269-Q. Theory of Plasticity. I. Correlation Between Lattice Transformation and Plastic Gliding in Metals. II. Critical Shear Stress of Binary Alloys. (In English.) Sakae Takeuchi and Hideji Suzuki. *Science Reports of the Research Institutes, Tohoku University*, ser. A, v. 2, Feb. 1950, p. 50-67.
Part II includes correlation of theoretical conclusions with experimental observations for Au-Ag, Cu-Ni, and Cu-Zn alloys.
(Q23, N general)

270-Q. Measurement of Coefficient of Static Friction of Metals. (In English.) Ryoji Aida. *Science Reports of the Research Institutes, Tohoku University*, ser. A, v. 2, Apr. 1951, p. 380-395.
Measurement for a wide variety of ferrous and nonferrous metals, also under different experimental conditions. Extensive tabular and graphical data. (Q9)

271-Q. Room Temperature Creep and Relaxation. *Metal Progress*, v. 59, Apr. 1951, p. 546, 548. (Translated and condensed from "Relaxation of Austenitic Steel at Room Temperature", I. A. Oding and E. N. Volosatova.
Previously abstracted from *Doklady Akademii Nauk SSSR* (Reports of the Academy of Science of the USSR). See item 502-Q, 1950.
(Q3, SS, Fe)

272-Q. Vibration and Fatigue Life of Steel Strand. J. C. Little, D. G. Macmillan, and J. V. Majercak. *Transactions of the American Institute of Electrical Engineers*, v. 69, pt. 2, 1950, p. 1473-1478; disc. p. 1478-1479.
See abstract of condensed version in *Electrical Engineering*, item 847-Q, 1950. (Q7, CN, SS)

273-Q. Effects of Prior Stress on the Fatigue of Aluminum Alloys. J. E. Bennett and J. L. Baker. *Light Metal Age*, v. 9, Apr. 1951, p. 16-17.
See abstract under similar title from *Journal of Research of the National Bureau of Standards*, item 15-Q, 1951. (Q7, Al)

274-Q. Navy Studies Jet Structural Alloys at Intermediate Temperatures. J. F. Erthal. *Iron Age*, v. 167, May 10, 1951, p. 91-95.
Room - temperature mechanical properties of Inconel X changed little after heating at 900° F. for up to 1000 hr. Strength of Stainless W increased up to 700° F., but 4340 decreased at this temperature. In some cases, impact properties of Stainless W were 60-170% higher at 700° F. than at room temperature. Results are of special significance because of aerodynamic heating incident to operation at supersonic speeds.
(Q general, Ni, SS)

275-Q. An Automatic Light-Load Bergsman Type Hardness Tester. P. Grodzinski. *Journal of Scientific Instruments*, v. 28, Apr. 1951, p. 117-121.
By means of special equipment, fully automatic control was applied to operation of a stronger model of a Bergsman-type light-load hardness tester used in association with a Vickers projection microscope. Reliability of hardness testing was increased by eliminating manual control of the indenting operation and by redesigning the indenter. (Q29)

276-Q. Effect of Alloying Elements on True-Stress True-Strain Flow Curves of Pearlitic Steel. R. Raring, J. A. Rinebolt, and W. J. Harris, Jr. *Journal of Metals*, v. 3, May 1951; *Transactions of the American Institute of Mining and Metallurgical Engineers*, v. 191, 1951, p. 395-400.
Effects of additions on true stress-strain curves of 0.30% C, 1.00% Mn, 0.30% Si pearlitic steel were studied. The elements investigated were C, Mn, Si, P, Ni, Cu, V, Mo, Cr, Al, B, S, and Ti. Alloys are compared on the basis of fracture stress, fracture strain, energy to fracture, rate of strain hardening, strain-hardening exponent, height of the flow curve, and lower yield point. 10 ref.
(Q23, AY)

277-Q. The Effect of Brake Shoe Action on Thermal Cracking and on Failure of Wrought Steel Railway Car Wheels. Harry R. Wetenkamp, Omar M. Sidebottom, and Herman J. Schrader. *University of Illinois Bulletin*, v. 47, June 1950, 104 pages. (Engineering Experiment Station, Bulletin Series 387.)
Mechanical-property data were obtained for wheels having two types of heat treatment, various carbon contents, and two methods of wheel manufacture. Data were from notched and unnotched static tension specimens, Brinell-hardness determinations, and endurance limits for notched and unnotched rotating-beam, bending-fatigue specimens. For a few types of wheels, a photomicrographic study was made of structure of the material before and after drag testing. A number of variables of heat treatment, wheel design, carbon content, and method of wheel manufacture were investigated. (Q general, S21, CN)

278-Q. An Investigation of Creep, Fracture, and Bending of Arsenical Lead Alloys for Cable Sheathing—Series 1949. Curtis W. Dollins. *University of Illinois Bulletin*, v. 47, Oct. 1950, 60 pages. (Engineering Experiment Station, Bulletin Series 394.)
The data cover creep rates under steady tensile stresses up to 300 psi., time to fracture under steady stresses of 400 to 2000 psi., and number of cycles to fracture in slow bending. Small amounts of As in combination with other constituents and with proper production technique were shown to produce a marked improvement in creep resistance, life to fracture, and ability to withstand bending. This improvement appears to be due to retardation of recrystallization at the stresses and temperatures generally encountered in service. 17 ref.
(Q3, Q5, Q26, Pb)

279-Q. Strainhardening and Softening With Time in Reference to Creep and Relaxation in Metals. A. Nadai. *American Society of Mechanical Engineers*, Paper 50-A-121, 1950, 24 pages.
Analytical expressions for describing the influence of strain hardening, of the time rate of change of

the flow resistance, and of recovery strains on creep and relaxation of metals under uniaxial stress. (Q3)

280-Q. Relaxation of Stress in a Heat Exchanger Tube of Ideal Material. E. A. Davis. *American Society of Mechanical Engineers,* Paper 50-A-122, 1950, 11 pages.

Analytical solutions of the relaxation of an elasticoviscous tube in a rigid tube sheet in both plane stress and modified plane strain are worked out. Effect of reloading tensile specimens in relaxation and results of tests on an Al alloy. (Q27)

281-Q. Effect of Vanadium on the Properties of Cast Chromium-Molybdenum Steels. N. A. Ziegler, W. L. Meinhard, and J. R. Goldsmith. *American Foundrymen's Society,* Preprint 51-2, Apr. 1951, 14 pages.

An investigation was made of microstructures, transformation temperatures, mechanical properties, and weldability of 1.25% Cr + 0.5% Mo, 2.5% Cr +0.5% Mo, and 5.0% Cr + 0.5% Mo cast steels, in which V ranged from 0 to 0.3% and carbon from 0.1 to 0.3% in each group. Results are presented in graphs and photomicrographs. 12 ref. (Q general, M27, N8, K9, CI)

282-Q. Influence of Silicon Content on Mechanical and High-Temperature Properties of Nodular Cast Iron. W. H. White, L. P. Rice, and A. R. Elsea. *American Foundrymen's Society,* Preprint 51-5, Apr. 1951, 9 pages.

Two series of cast irons of similar compositions, one containing flake and the other containing spheroidal graphite, were used. Growth and sealing characteristics were also investigated. (Q general, P general, CI)

283-Q. Effect of Phosphorus Content on Mechanical Properties of a Nodular Cast Iron. J. E. Rehder. *American Foundrymen's Society,* Preprint 51-43, Apr. 1951, 8 pages.

Mg-treated irons only are discussed, but results are applicable to other nodular irons. Photomicrographs show course of the graphitization process under different conditions of composition, heat treatment, etc. (Q general, E25, CI)

284-Q. Melt Quality and Fracture Characteristics of 85-5-5-5 Red Brass and 88-8-4 Bronze. R. D. Shelleng, C. Upthegrove, and F. B. Rote. *American Foundrymen's Society,* Preprint 51-55, Apr. 1951, 10 pages.

Third progress report by Research Committee of A.F.S. Brass and Bronze Div. on development of a fracture-test procedure for evaluating the melt quality of brass and bronze alloys. Effects of variations in size and shape of the chill block casting and variation in temperature of the chiller from room temperature to 700° F. on the fracture appearance of 85-5-5-5 alloy chill blocks. A determination of the cooling rates in a ¾ in. x 3 in. x 6 in. chill block was also made. Relations between melt quality and appearance of 88-8-4 alloys. Influence of degassing with dry N_2 on the fracture appearance and melt quality of 85-5-5-5 and 88-8-4 alloys. (Q26, E25, Cu)

285-Q. A High-Speed, High-Temperature Precision Testing Machine for Gas Turbine Disk Research. A. C. Hagg, B. Cametti, and G. O. Sankey. *Proceedings of the Society for Experimental Stress Analysis,* v. 8, No. 2, 1951, p. 17-28.

Apparatus can handle disk specimens up to 14 in. in diam. and 2 in. thick, and larger specimens can be handled with only minor modifications. The furnace is designed for a specimen temperature up to 1500° F. which may be uniform with radical gradients up to about 100° F. per in. Primary emphasis was placed on means for accurate measurement and control of specimen speed and temperature, and on determination of plastic and creep status. (Q27, Q3, SG-h)

286-Q. Bursting Tests of Rotating Disks Typical of Small Gas Turbine Design. Wallace E. Skidmore. *Proceedings of the Society for Experimental Stress Analysis,* v. 8, No. 2, 1951, p. 29-48.

A variety of disks, mostly of simple basic shapes, were made and tested to destruction. Some of the items investigated were effect of material, profile, centrally located holes, and blade loading. Yield speed, bursting speed, and elongation data were obtained. Stresses for yield and ultimate speeds were computed in terms of average stress and maximum elastic stress. Results were compared with material tensile properties determined from tensile test coupons. Results indicated that theoretical elastic stresses are not always a definite criteria of failure. (Q21, Q23)

287-Q. Passenger Car Frame Analysis and Strain Gage Tests. V. L. Green. *Proceedings of the Society for Experimental Stress Analysis,* v. 8, No. 2, 1951, p. 49-62.

Details of the work, including overall and detailed diagrams. Benefits obtained from the tests. (Q25, CN)

288-Q. A Method of Inferring the Strength of Structures at High Temperature From Room Temperature Model Tests. W. Kenneth Bodger. *Proceedings of the Society for Experimental Stress Analysis,* v. 8, No. 2, 1951, p. 63-68.

Method developed for using the results of tests on ordinary plastic materials to predetermine the load-carrying capacity of a structure which operates under creep conditions. Geometric similarity of model and prototype are assumed. The method was applied in detail to the case of a structure whose deformation is due largely to bending; it can readily be adapted to cases of tension, shear, or combined stresses. A suggestion is made for studying the problems of creep in structures by photoelastic methods. (Q25, Q3)

289-Q. Transverse Waves in Beams. Irwin Vigness. *Proceedings of the Society for Experimental Stress Analysis,* v. 8, No. 2, 1951, p. 69-82.

Object was primarily to describe the lateral motions of a beam under controlled impact conditions. The problem was originally initiated to explain features associated with transmission of mechanical shock waves and to determine maximum stresses occurring in simple structures under impact conditions. Experimental results are compared with those of infinite-beam theory as well as some results of the theory of finite beams. 12 ref. (Q6)

290-Q. Deflection Tests of Plastic Models. Roscoe Meadows, Jr. *Proceedings of the Society for Experimental Stress Analysis,* v. 8, No. 2, 1951, p. 117-128.

Scale models of a gun turret and of a low-pressure steam-turbine casing were tested to find relative deflections to be expected in prototypes. Two groups of box girder models were made. Each group contained dimensionally identical girders of cellulose acetate, methyl, methacrylate and brass, and geometrically similar girders of different scales. Deflections of these girders under various loads were measured and compared with calculated deflections. From these comparisons, methods of overcoming errors due to creep, temperature variations, and aging of cemented joints were developed. 11 ref. (Q25)

291-Q. Some Observations on Photoelastic Materials Stressed Beyond the Elastic Limit. Bernard Fried. *Proceedings of the Society for Experimental Stress Analysis,* v. 8, No. 2, 1951, p. 143-148.

Materials studied were polystyrene, lucite, plexiglass, nylon, cellulose acetate, AgCl, and cellulose nitrate. The most suitable material tested, from the point of view of application to solution of problems in technical mechanics, was cellulose nitrate. (Q25)

292-Q. Factors of Stress Concentration in Bars With Deep Sharp Grooves and Fillets in Tension. M. M. Frocht and D. Landsberg. *Proceedings of the Society for Experimental Stress Analysis,* v. 8, No. 2, 1951, p. 149-162; disc. p. 163-170.

Determined photo-elastically. Results are limited to the elastic range. Apparatus and data; photo-elastic stress patterns. Includes extensive discussion by A. J. Durelli and R. H. Jacobson. 13 ref. (Q25)

293-Q. Advances in High-Temperature Strain Gages and Their Application to the Measurement of Vibratory Stresses in Hollow Turbine Blades During Engine Operation. R. H. Kemp, W. C. Morgan, and S. S. Manson. *Proceedings of the Society for Experimental Stress Analysis,* v. 8, No. 2, 1951, p. 209-228.

Improved high-temperature strain gage found satisfactory for measuring vibratory strains in a turbine blade during operation of a turbo-jet engine. Components were Karma wire or 80% Pt, 20% Ir tubular lead wires, National Bureau of Standards L-6AC precoat, and Quigley AAA No. 1925 cover ceramic. Strain sensitivity was measured statically at room temperature and dynamically at temperatures up to 1500° F. (Q25)

294-Q. The Significance of Mechanical Testing. E. W. Blumer. *Australasian Engineer,* v. 44, Jan. 8, 1951, p. 65-69.

Tensile, impact, and bend testing. (Q27, Q5, Q6)

295-Q. The Equilibrium of Linear Arrays of Dislocations. J. D. Eshelby and F. R. N. Nabarro. *Philosophical Magazine,* ser. 7, v. 42, Apr. 1951, p. 351-364.

A method for finding the equilibrium positions of a set of like dislocations in a common slip-plane under the influence of a given applied stress. The case of a set of free dislocations piled up against a fixed dislocation by a constant applied stress is discussed in detail and the resulting stress-distribution is compared with that produced by a crack with freely slipping surfaces. 16 ref. (Q24)

296-Q. The Use of Plasticine Models to Simulate the Plastic Flow of Metals. A. P. Green. *Philosophical Magazine,* ser. 7, v. 42, Apr. 1951, p. 365-373.

The behavior of plasticine when permanently deformed was compared with that of an ideal metal, and necessary conditions for similarity between their flow patterns were examined for flow in two and three dimensions. Processes thus examined were extrusion through square and wedge-shaped dies; indentation of a plane surface by a single wedge and by a row of wedges; and compression of a narrow wedge by a flat die. Profile of a deep narrow block after a small indentation by a flat punch was also compared with theory. Compression of a narrow Cu wedge by a smooth flat die resulted in similar deformation to that of plasticine wedge. (Q24)

297-Q. A Theory of the Plastic Distortion of a Polycrystalline Aggregate Under Combined Stresses. J. F. W. Bishop and R. Hill. *Philosophical Magazine,* ser. 7, v. 42, Apr. 1951, p. 414-427.

A general relationship between stress and plastic strain in a polycrystalline aggregate is derived for

any metal in which individual crystals deform by slipping over preferred planes under a critical shear stress. Shows that a plastic potential exists which is identical with the yield function. Upper and lower limits are obtained for approximate calculation of this function for any applied system of combined stresses. 13 ref. (Q24)

298-Q. Microscopical Examination of Creep Specimens. E. A. Jenkinson. *Engineer,* v. 191, Apr. 13, 1951, p. 469-472.

Forms an Appendix to "Fracture Under Combined Stress Creep Conditions of a 0.5% Mo Steel," by A. E. Johnston and N. E. Frost (Apr. 6 issue; see item 255-Q). 22 photomicrographs show structures before and after test. (Q3, M27, AY)

299-Q. The Effect of Copper, Silicon and Magnesium on the Mechanical Properties of Aluminium Alloys of the D.T.D. 424 Type. E. Scheuer, S. J. Williams, and J. Wood. *Journal of the Institute of Metals,* v. 79, Apr. 1951, p. 57-72.

Ultimate tensile stress, proof stress, elongation, and Brinell hardness of 81 alloys were determined and recorded in contour diagrams based on the ternary diagram for Al-Cu-Si alloys. The investigation included alloys with four different Mg contents (0.00, 0.08, 0.15, 0.25%). Graphs are also given showing effect of varying either Cu or Si content while keeping the other constituents constant. (Q27, Q29, Al)

300-Q. Some New Observations on the Mechanism of Fatigue in Metals. W. A. Wood and A. K. Head. *Journal of the Institute of Metals,* v. 79, Apr. 1951, p. 89-102.

Response of the crystalline structure of a metal to static stressing was compared by X-ray diffraction methods with its response to cyclic or fatigue stressing. Degree of suppression is shown to depend in part on the alternating character of deformation under cyclic stress. There appears to be a critical rate above which suppression of disorientation sets in abruptly. Experimental work was done mainly with Cu, plus some tests on Al. (Q7)

301-Q. Testing the Metal or the Casting. J. W. Bolton. *Foundry Trade Journal,* v. 90, Apr. 12, 1951, p. 389-390, 393.

Critically discusses recent paper of above title by E. O. Lissell (see item 568-Q, 1950). Indicates that neither the data nor the conclusions provide a sound solution of the broad problem proposed. Emphasis is on ferrous castings. (Q general, S22, CI)

302-Q. New Possibilities of Measuring Stresses With Short X-Rays. (In German.) Hermann Möller. *Archiv für das Eisenhüttenwessen,* v. 22, Mar.-Apr. 1951, p. 137-142.

Method based on determining lattice constants of the elastically stressed test specimen in different directions and obliquely to the surface. The method is limited to measuring states of stress to a depth of 0.01-0.02 mm., provided elastic constant of the material is known. Includes X-ray pictures, graphs, tables, and photographs. 11 ref. (Q25)

303-Q. Testing the Sensitivity of Weldable Structural Steels to Brittle Fracture. (In German.) Erich Folkhard. *Stahl und Eisen,* v. 71, Mar. 29, 1951, p. 347-351.

Effect of welding on sensitivity to brittle fracture. Includes a critical study of the validity of different testing methods. (Q23, K9, CN)

304-Q. Special Features in the Change of Crystal Structure of a Metal During Deformation in Surface-Active Media. (In Russian.) V. N. Pozhanskii, T. A. Amfiteatrova, and P. A. Rebinder. *Doklady Akademii Nauk SSSR* (Reports of the Academy of Sciences of the USSR), new ser., v. 76, Feb. 11, 1951, p. 697-698.

Kinetics of plastic deformation of a Cu wire in surface-active and inactive media was studied. Data indicate that the effect of surface-active agents in minimizing metal deformation of wire 0.05 mm. in diam. is at a maximum for a grain size of 0.09 mm. Method of investigation. (Q24, Cu)

305-Q. Statitron Will Workharden Aluminum Alloys, Build Forces to Cause Failure, Harden Non-Heat-Treatable Metals, Alter Physical Properties of Metals Instantly. Frank Charity. *American Machinist,* v. 95, May 14, 1951, p. 134-135.

The Statitron is a midget version of the Van de Graff electrostatic generator. It is an electromechanical device, intended to convert ordinary electrical current into a high-voltage electron beam which is similar in output to the X-ray machine, except that it has the intensity necessary to alter the physical properties of metallic materials. Use for engineering tests to determine stresses that cause material failures. Diagram shows features of construction. (Q25, S13, J general)

306-Q. Armor Plate Resistance; The Terminal Properties of Small-Arms Projectiles. H. F. Kohlbacker. *Ordnance,* v. 35, May-June 1951, p. 632-635.

Deals primarily with projectiles between .22 and .50 caliber. Correlation of experimental results obtained during long research in the field of projectile behavior and phenomena against hard targets. Alloy and mild steel armor plate were tested. (Q6, T2, CN, AY)

307-Q. Residual Stresses Can Increase Fatigue Strength. *SAE Journal,* v. 59, May 1951, p. 38-40. (Based on "Stresses Imposed by Processing," by O. J. Horger.)

Recent investigations indicate that certain states of residual stress improve the fatigue strength of production parts. This new concept has completely changed the designer's point of view. Attention is now given to retaining thermal and transformation stresses rather than relieving them. Experimental data on SAE 1050 steel, supporting this concept. (Q7, Q25, CN)

308-Q. Distribution of Locked-In Stresses in a Large Welded Steel Box Girder. D. Rosenthal. *Welding Journal,* v. 30, May 1951, p. 250s.

Discusses paper by John Vasta. (Sept. 1950 issue; item 651-Q, 1950.) (Q25, CN)

309-Q. The Micro-Mechanism of Fracture in the Tension-Impact Test. *Welding Journal,* v. 30, May 1951, p. 255s-259s.

Several individuals discuss separately above paper by W. H. Bruckner. (Sept. 1950 issue; item 649-Q, 1950.) Includes author's reply. (Q27, ST, Fe)

310-Q. Room Temperature Tensile Tests an Index of Transition Temperature of Steel Plates. *Welding Journal,* v. 30, May 1951, p. 259s.

C. F. Tipper discusses above paper by S. S. Tör, R. D. Stout, and B. G. Johnston. (Sept. 1950 issue; item 650-Q, 1950.) (Q27, ST)

311-Q. Scatter in Transition Test Curves. Adrienne F. Scotchbrook, Bruce G. Johnston, and Robert D. Stout. *Welding Journal,* v. 30, May 1951, p. 266s-271s.

Construction of transition-temperature curves of steels requires a knowledge of testing-temperature interval, number of tests at each temperature, and reproducibility of measurements as well as a basis for indicating the transition temperature. (Q23, ST)

312-Q. The Determination of Initial Stresses and Results of Tests on Steel Plates. *Welding Journal,* v. 30, May 1951, p. 272s.

Discusses above paper by E. W. Suppiger, C. Riparbelli, and E. R. Ward. (Feb. 1951 issue; see item 96-Q, 1951.) (Q25, CN)

313-Q. Hardness Testing. H. Schulz. *Microtecnic* (English Ed.), v. 5, Jan.-Feb. 1951, p. 6-9. (Translated from the German.)

Fundamental principles. Compares results obtained by different methods on different materials. (Q29)

314-Q. Bergsman Method for Hardness Testing. *Microtecnic* (English Ed.), v. 5, Jan.-Feb. 1951, p. 28-30.

Swiss-made microhardness testing equipment in assembly with a metallurgical microscope. (Q29)

315-Q. Influence of Impurities on the Form of Tensile Curves. (In French.) Bernard Jaoul. *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences,* v. 232, Feb. 12, 1951, p. 595-596.

Particularly additions capable of forming solid solutions with Al, such as Zr, Mn, W, Si, and Cu. Data are charted. (Q27, Al)

316-Q. Remark Concerning Determination of the Point of Origin of Fracture During Tensile Testing of Mild Steel. (In French.) Georges A. Homes and Jacques Goudzou. *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences,* v. 232, Feb. 12, 1951, p. 596-598.

Experimental proof of the hypothesis that the above point is located in the interior of the test specimen, the fracture progressing from the inside toward the periphery of the specimens. Includes micrographs. (Q27, CN)

317-Q. Creep Resistance of Malleable Aluminum Alloys. (In German.) H. Vosskühler. *Metall,* v. 5, Apr. 1951, p. 135-141.

Experimentally established data. Effect of test temperature and alloy composition on creep resistance. 12 ref. (Q3, Al)

R

CORROSION

181-R. Protecting Against White Rusting of Zinc Plated Parts. P. T. Gilbert and S. E. Hadden. *Metal Finishing,* v. 49, Apr. 1951, p. 66-69.

Condensed from "'White Rust' Formation on Zinc," *Journal of the Institute of Metals.* See item 67-R, 1951. (R3, Zn)

182-R. How to Protect Your Steel. J. B. Scott. *Chemical Engineering,* v. 58, Apr. 1951, p. 135-138.

Methods used at the Adams Terminal Plant of the Phillips Chemical Co., to protect steel in highly corrosive atmospheres. Dry sand blasting, types of coatings, effect of porosity, optimum coverage, drying time of coating, small scale testing, use of cheaper coatings, and thin edges. (R3, L general, ST)

183-R. Two Power Take-Off Problems Licked in Corrosive Atmosphere. *Inco Magazine,* v. 24, Spring 1951, p. 16.

Use of monel fasteners and pins of "K" monel on V-belts around tanning drums at the Hermann Loewenstein Co., Inc. distributors of buckskin and calf leather. (R7, T29, Ni)

184-R. Hard on Bugs and Hard on Pumps. *Inco Magazine,* Spring, 1951, p. 17.

Corrosion of spraying equipment by farm sprays, weed killers, etc., and use of Ni-Resist pump, manufactured by Hypro Engineering, Inc. (R7, T3, Ni)

185-R. Composite Wire With Many Uses. *Inco Magazine,* Spring, 1951, p. 20.

Advantages of Ni-clad Cu wire in high-temperature and corrosive service.
(R general, T general, Ni, Cu, SG-g, h)

186-R. High Strength Alloy Fights Corrosion in Oil Wells. *Inco Magazine,* Spring 1951, p. 26-27.

Use of Nicloy 9, a low-carbon, 9% Ni steel for tubing. (R7, T28, AY)

187-R. Durability of Aluminium and Its Alloys—The Food Industry. *Light Metals,* v. 14, Mar. 1951, p. 133-138; Apr. 1951, p. 189-194.

Incidence of galvanic attack in the food industry from dairy products, fruit juices, and alcoholic beverages. Concluding part: effects of oils, fats, and meats on domestic utensils and food containers made of aluminium.
(R7, T29, Al)

188-R. Fundamental Researches on Corrosion. U. R. Evans. *Engineering,* v. 171, Apr. 13, 1951, p. 443-444. (A condensation.)

A lecture, emphasizing conclusions based on research at Cambridge, England. Also protection by means of miscellaneous coating types.
(R general, L general)

189-R. Contribution to the Study of Pickling Inhibitors. (In French.) G. Batta, L. Shceepers, and L. Bousmanne. *Revue de Métallurgie,* v. 48, Feb. 1951, p. 105-114; disc. p. 114-115.

Theoretical considerations on corrosion inhibitors show that a relationship exists between molecular structure and inhibitory action of organic compounds on Fe, Al, and Ni. The same inhibitors behaved abnormally on Zn; alcohols, aldehydes, ketones, amines, phenols, halogenated hydrocarbons, and CS_2 were investigated. (R10, Fe, Al, Ni)

190-R. Rust-Preventive Processes and Agents in the Technical and Patent Literature. (In German.) Richard Springer. *Metalloberfläche,* v. 5, ser. A, Feb. 1951, p. 22-28; Mar. 1951, p. 43-46.

Reviews literature and patents. 113 ref. (R10)

191-R. Some Basic Considerations With Respect to Formation of Protective Layers on Lead and on Solubility of Lead in Drinking Water. (In German.) Johannes Müller. *Gas- und Wasserfach,* v. 92, Feb. 28, 1951, p. 39-42.

Pros and cons of using lead pipes for drinking water lines. Differences between protective layers on lead and iron. Reactions of water with the lead and with coatings which form on the inside of the pipes; suspensions of Pb compounds and their reactions with cations present in the water. Importance of the absence of porosity in the protective layers. 12 ref. (R4, T4, Pb)

192-R. Chromates as Retarders of Corrosion Caused by Wood Preservatives. (In German.) H. Hadert. *Werkstoffe und Korrosion,* v. 2, Feb. 1951, p. 49-51.

Recommendations as to type and amount of inhibitor for specific wood preservatives. (R10)

193-R. Measuring the Oxide Film on Platinum. (In German.) H. Grubitsch. *Werkstoffe und Korrosion,* v. 2, Mar. 1951, p. 85-89.

Criticizes Todt's method. Shows that the amount of oxide on the Pt surface is proportional to the absolute, not the active, surface. (R2, Pt)

194-R. Materials and Soils. (In German.) L. W. Haase. *Werkstoffe und Korrosion,* v. 2, Mar. 1951, p. 90-93.

Corrosive effects of different types of soil on Fe, Cu, Zn, Pb, and their alloys; chemical effect of soils on cement, asbestos cement, concrete, ceramics, and wood.
(R8, Fe, Cu, Zn, Pb)

195-R. Corrosion Behavior of Ferritic and Pearlitic Cast Iron Containing Spheroidal Graphite; A Critical Discussion. (In German.) E. Franke. *Werkstoffe und Korrosion,* v. 2, Mar. 1951, p. 101-103.

Data indicate that neither quantity nor form of graphite in cast iron has any marked effect on resistance to corrosion. 19 ref.
(R general, CI)

196-R. Investigation of the Process of Passivation of Iron in the System HNO_3-H_2SO_4-H_2O. (In Russian.) I. Oknin. *Zhurnal Prikladnoi Khimii* (Journal of Applied Chemistry), v. 24, Jan. 1951, p. 61-73.

Experimental investigation showed that passivation of a self-soluble metal occurs when the maximum rate of the high-potential cathode process in an oxidizing reaction medium (maximum cathode current density) exceeds the maximum rate of the low-potential, active anode process (maximum anode current density). Mechanisms of anodic polarization are proposed for solution of different compositions. Method of investigation is described and results. 42 ref. (R10, Fe)

197-R. Corrosion of Thin Wires. I. Corrosion of Thin Wires of German Silver, Eureka, Copper, and Iron by Sea Water. (In English.) Hiroshi Yoshisaki. *Science Reports of the Research Institutes, Tohoku University,* ser. A, v. 2, Feb. 1950, p. 96-101.

The manner of progress of corrosion in relation to structural considerations. ("Eureka" is an alloy of 42.32% Ni, 1.13% Mn, balance Cu.)
(R4, Cu)

198-R. On the Inhibitor for the Corrosion by Hydrochloric Acid on High-Chromium Steels. (In English.) Hikozo Endo and Saburo Isihara. *Science Reports of the Research Institutes, Tohoku University,* ser. A, v. 2, Apr. 1950, p. 209-215.

Action of $K_2Cr_2O_7$ as inhibitor for corrosion by HCl of high Cr steels was investigated. Mo added to high Cr steels, so far as it goes into solid solution, is very effective in lowering the minimum quantity of $K_2Cr_2O_7$ and in preventing pit or cavity corrosion of high Cr steels. Was not as effective as Mo with respect to corrosion resistance of high Cr steels. (R10, SS)

199-R. Welding and Stress-Corrosion Cracking. *Metal Progress,* v. 59, Apr. 1951, p. 568, 570, 572, 574, 576, 578, 580. (Condensed from "Stress-Corrosion Cracking in Welded Steel Structures," C. E. Pearson and R. N. Parkins.)

Previously abstracted from *Welding Research.* See item 65-R, 1950.
(R1, CN)

200-R. Formation of Oxides on Some Stainless Steels at High Temperatures. H. M. McCullough, M. G. Fontana, and F. H. Beck. *Industrial Heating,* v. 18, Apr. 1951, p. 638, 640, 642.

Previously abstracted from *American Society for Metals,* Preprint 4, 1950. See item 406-R, 1950. (R2, SS)

201-R. Corrosion. Mars G. Fontana. *Industrial and Engineering Chemistry,* v. 43, May 1951, p. 69A-70A, 72A.

A general discussion of the corrosion of underground pipelines, its causes and prevention. (R8)

202-R. Rail Corrosion in the Moffat Tunnel. Walter Leaf. *Corrosion* (News Section), v. 7, May 1951, p. 1.

Methods being tested to minimize corrosion of rail, tie plates, and spikes. (R3, T23, CN)

203-R. A Polarographic Method for the Continuous Determination of the Consumption of Oxygen in Corrosion Tests. Paul Delahay. *Corrosion* (Technical Section), v. 7, May 1951, p. 146-150.

The corroding solution flows at a constant rate in a cell containing the specimen. Concentration of O_2 at the outlet of the cell is measured by a polarographic method. Calculation of the rate of O_2 consumption and a few examples. Various factors which cause rate of oxygen consumption to differ from rate of corrosion. A method for computing relative amounts of ferrous and ferric derivatives resulting from the corrosion of iron. 25 ref.
(R11, Fe)

204-R. Current Requirements for the Cathodic Protection of Steel in Dilute Aqueous Solutions. G. R. Kehn and E. J. Wilhelm. *Corrosion* (Technical Section), v. 7, May 1951, p. 156-160.

Laboratory method, based upon colorimetric analysis, for finding the minimum current density required. Minimum current densities determined by this method are compared with those obtained from a Britton curve for each of the two test solutions. Significance of the values determined by these two methods.
(R10, ST)

205-R. Corrosion Problems Related to Air Transport Aircraft. O. E. Kirchner and F. M. Morris. *Corrosion* (Technical Section), v. 7, May 1951, p. 161-177.

The problems, their causes and treatment, and prevention of such corrosion by proper design, maintenance of surface treatments and coatings, and cleaning operations.
(R3, L general)

206-R. Influence of Temperature on Corrosion Rates in Moving Conditions. F. Wormwell and H. C. K. Ison. *Chemistry & Industry,* v. 15, Apr. 14, 1951, p. 293.

Experiments on influence of temperature and surface finish on corrosion rate of mild steel in 0.1 N NaCl in the range 22-30° C. Influence of temperature on corrosion rate is far greater than expected from previous work in stationary conditions or from data in the literature. (R5, CN)

207-R. Electrochemical Behaviour of Paint Films in Sea-Water. J. E. O. Mayne. *Chemistry & Industry,* v. 15, Apr. 14, 1951, p. 293-294.

Data on coated and uncoated mild-steel specimens. (R4, CN)

208-R. Cracking of an Al-Mg Alloy in Contact With Mercury. (Concluded.) (In French.) Pierre A. Jacquet and A. R. Weill. *Revue de l'Aluminium,* v. 28, Jan. 1951, p. 4-10.

Results of experiments which show that there is no relation between microstructure and crack formation in the presence of Hg. Influence of thermal and mechanical treatments, micrographic aspects of cracking, and relation between cracking caused by mercury and stress corrosion. 11 ref. (R6, Al)

209-R. Problems of Material in the Design of Chemical Equipment. (In German.) L. Piatti. *Schweizer Archiv für angewandte Wissenschaft und Technik,* v. 17, Mar. 1951, p. 80-91.

Failures and successes of steels in high-temperature, high-pressure reactions in the presence of H_2; corrosion from galvanic, stray, and local currents and from micro-organisms; contact, intercrystalline, transcrystalline, and fatigue corrosion; caustic brittleness; frictional oxidation; cavitational wear; and high-temperature corrosion. Ways of minimizing these effects are indicated. 12 ref. (R1, R2, T29, ST)

210-R. The Scaling Process and Short-Time Tests of the Life of Heat Conducting Alloys. (In German.) Helmut Krainer, Leopold Wetternik, and Carl Carius. *Archiv für das Eisenhüttenwesen,* v. 22, Mar.-Apr. 1951, p. 103-110; disc. p. 110.

Test results for a steel containing 25% Cr and 20% Ni, an alloy of 80% Ni and 20% Cr; and a steel containing 24% Cr and 5.5% Al. Resistance of these alloys to tempera-

ture changes differs widely. Short-time tests indicate that no simple correlation exists between scaling and life. The problems of wire thickness, test temperature and time, and reproducibility of results. 23 ref. (R2, AY, Ni)

211-R. Reactions of Cadmium With Oxides of Carbon. (In Russian.) D. M. Chizhikov, E. I. Khazonov, and A. G. Nikonov. *Izvestiya Akademii Nauk SSSR* (Bulletin of the Academy of Sciences of the USSR), Section of Technical Sciences, Jan. 1951, p. 68-73.

Investigation showed that Cd above its boiling point (768° C.) is not subject to oxidation by CO; oxidation of Cd by CO_2 with formation of sooty carbon takes place below 350° C.; oxidation of Cd by CO_2 is significant only near its melting point (319° C.). (R2, Cd)

212-R. The Reaction Between Oxygen and Thorium. Pascal Levesque and Daniel Cubicciotti. *Journal of the American Chemical Society,* v. 73, May 1951, p. 2028-2031.

A study of the oxidation of Th was made in order to make comparison with oxidations of other metals of group IVB of the Periodic table. The reaction was studied in the range 250-700° C. Rate constants for the linear oxidation were measured and energy of activation calculated. (R2, P13, Th)

213-R. Studies in the Corrosion of Metals Occasioned by Aqueous Solutions of Some Surface-Active Agents. I. Copper. H. Holness and T. K. Ross. *Journal of Applied Chemistry,* v. 1, Apr. 1951, p. 158-169.

The action of dilute aqueous solutions of representative anionic, cationic, and nonionic wetting agents on sheet Cu was studied. Three types of water were used—London tap-water, distilled water and tap-water softened by the zeolite base-exchange process. Effects of varying the pH of the solutions from 2 to 12 and of temperature changes were investigated. All results are expressed graphically, and a mechanism is suggested. (R5, Cu)

214-R. Do Salts Used for Ice Control Speed Rusting of Automobiles? *Engineering News-Record,* v. 146, May 17, 1951, p. 39-41.

Arguments on both sides of this question and need for further study. Investigations made in Michigan and Akron. (R6)

215-R. Tracer Method for Evaluating Rust Preventatives. Stanley L. Eisler. *Nucleonics,* v. 8, May 1951, p. 76-79.

Method which has overcome the shortcoming of the testing procedures used to evaluate these compounds during U. S. Army procurement. Comparison data are tabulated. (R11, S19, Fe)

216-R. How Hydrogen Attacks and Damages Steel in Refinery Equipment. R. T. Effinger, M. L. Renquist, A. G. Wachter, and J. G. Wilson. *Oil and Gas Journal,* v. 50, May 17, 1951, p, 99-100, 103-104, 108, 110, 113-114, 117, 130-131, 133-134.

The phenomenon by which hydrogen damages steel in conventional refinery equipment. Limited to the attack which occurs with the types of low-carbon steel commonly utilized in the construction of refinery process equipment and piping. Also limited to the attack associated with aqueous corrosion, in which the hydrogen which penetrates the steel is a product of the electrolytic corrosion cell. 32 ref. (R1, N1, CN)

217-R. Corrosion Program for a Pipe Line. Marshall E. Parker. *Petroleum Engineer,* v. 23, May 1951, p. D68, D70, D72, D74, D76-D80.

Detailed recommendations for planning the program. (R general, CN)

218-R. Taking Corrosion Measurements. Francis Ringer. *Petroleum Engineer,* v. 23, May 1951, p. D115-D116, D118-D120.

The Susquehanna electrolysis meter and vacuum-tube voltmeter, which has been found by Texas Eastern Transmission Corp. and others to be versatile field instruments for use in obtaining various measurements in corrosion investigation and control work on buried pipe, cable, or other structures. (R8)

219-R. Hydrogen Attack on Steel. R. T. Effinger, M. L. Renquist, J. G. Wilson, and A. Wachter. *Petroleum Processing,* v. 6, May 1951, p. 500-504.

Simplified flow diagrams show the basic features of catalytic gas-cracking plants and indicate locations where hydrogen attack may occur. Shell Oil Co. investigations indicated that H_2 attack occurs in low-C steel and is associated with aqueous solutions. (R2, CN)

220-R. Corrosion Cut in TCC Gas Plant. C. A. Murray and M. A. Furth. *Petroleum Processing,* v. 6, May 1951, p. 504-506.

Successful corrosion prevention and control by means of water-removal measures in operation in Texas at a Pure Oil refinery. Method, causes, benefits, and an example of the program. (R10, ST)

221-R. How to Avoid Galvanic Corrosion. *Steel,* v. 128, May 21, 1951, p. 82-83, 104, 106, 109-110.

Definition and practical factors for control. Al and Mg are of particular importance in dissimilar metal contacts. Crevice corrosion and Mg-assembly protection. (R1, Al, Mg)

222-R. Acid Treatment of Shale Gasoline. Part I. Hydrolysis of the Acid Sludge. R. C. Mathews and G. E. Mapstone. *Journal of the Institute of Petroleum,* v. 37, Mar. 1951, p. 147-157.

Results of an experimental investigation, including a study of corrosion of mild steel pipe by hydrolyzed acid and its inhibition by tar bases. (R5, CN)

223-R. Statistical Study of the Resistance to Corrosion of 18% Cr, 8% Ni Steel in Acid Copper Sulfate. (In French.) J. Bleton, J. Blanot, and P. Bastien. *Soudure et Techniques Connexes,* v. 4, Nov.-Dec. 1950, p. 261-262.

The charts compiled permit immediate prediction of the sensitivity to intergranular corrosion of castings, on the basis of their C and Cr contents. (R2, SS)

224-R. (Book) **Bibliographic Survey of Corrosion, 1946-1947.** 288 pages. 1951. National Association of Corrosion Engineers, 905 Southern Standard Bldg., Houston, Texas.

Has table of contents, cross references, subject and author indexes, and is arranged in a classification system. Abstract included for each reference. (R)

S

INSPECTION AND CONTROL

182-S. A Simple Instrument for Evaluating Polished or Buffed Surfaces. G. E. Gardam. *Metal Finishing,* v. 49, Apr. 1951, p. 61-63.

The method consists of the inspection, under standard conditions, of the reflected image of a strongly illuminated pattern of light and dark stripes, and determination of the maximum distance between lamp and object at which the light and dark stripes can be separately distinguished. The result is broadly independent of the curvature of the surface, and can be applied to relatively non-reflective surfaces, or alternatively these can be increased in surface reflectivity. The same apparatus is useful as a general qualitative inspection tool for quality of polish, absence of major defects, and for absence of haze and bloom. (S15, L10)

183-S. Spectrochemical Analysis of Bismuth Matrices; Porous Electrode Technique. Joseph C. Delaney and Louis E. Owen. *Analytical Chemistry,* v. 23, Apr. 1951, p. 577-580.

Corrosion studies required a spectrochemical procedure for analysis of Bi and Pb-Bi eutectic matrices containing 0.0001-0.5% Be, Co, Cr, Fe, Mn, Mo, Cb, Ni, Ta, Ti, V, and/or W. Details of procedure developed. (S11, Bi)

184-S. Differential Spectrophotometric Determination of High Percentages of Nickel. Robert Bastian. *Analytical Chemistry,* v. 23, Apr. 1951, p. 580-586.

A procedure by which Ni is determined to about ±0.05% in several samples, including electronic Ni, spectrographic Ni, and synthetic mixtures containing Cu, Cr, Fe, and Co. (S11, Ni)

185-S. Spectrophotometric Determination of Tellurium as the Iodotellurite Complex. Ralph A. Johnson and Francis P. Kwan. *Analytical Chemistry,* v. 23, Apr. 1951, p. 651-653.

New method for trace determination of Te, which should find applications of interest in metallurgy, biological science, and industrial hygiene. (S11, Te)

186-S. Ultrasonic Flaw Detection in Pipes by Means of Shear Waves. C. D. Moriarty. *Transactions of the American Society of Mechanical Engineers,* v. 73, Apr. 1951, p. 225-229; disc. 229-235.

Apparatus and procedure together with some basic information by which applicability to general pipe inspection can be evaluated. (S13)

187-S. Ultrasonics — Metalworking Tool? Charles Emerson and John Starr. *American Machinist,* v. 95, Apr. 30, 1951, p. 85-88.

Present and potential applications. Main emphasis in present uses is on nondestructive testing. Other uses are ultrasonic soldering, honing, and cutting. Additional possibilities. (S13, K7, G17)

188-S. Increasing Combustion Efficiency in the Steel Industry. J. G. Sparks. *Iron and Steel Engineer,* v. 28, Apr. 1951, p. 89-94; disc. p. 94-96.

By continuously analyzing O_2, unburnt hydrocarbons, and fuel gases as combustion occurs, efficient control can be applied to the combustion process. (S18, ST)

189-S. Solid Sample Analysis With the Mass Spectrometer. *U. S. Atomic Energy Commission,* AECD-3040, Oct. 24, 1949, 11 pages.

The Consolidated-Nier isotope-ratio mass spectrometer was modified to permit an experimental study of its application to the continuous analysis of solid samples. Features and construction. (S11)

190-S. The Use of High Efficiency Gamma Counting in Conjunction With Beta Counting for Discrimination Between Thorium and Uranium. Robert H. Roethlisberger. *U. S. Atomic Energy Commission,* AECD-3062, Aug. 20, 1949, 13 pages.

The gamma-beta method of radiometric discrimination between Th and U was tested on 12 mineral samples. Radio-assays for ThO_2 and U_3O_8 were within a factor of 2 of the chemical analyses, and usually within 15%. (S10, S19, U, Th)

191-S. Spectrographic Study of Platinum and Palladium in Common Sulphides and Arsenides of the Sudbury District, Ontario. J. E. Hawley,

C. L. Lewis, and W. J. Wark. *Economic Geology and the Bulletin of the Society of Economic Geologists,* v. 46, Mar.-Apr. 1951, p. 149-162.

Quantitative spectrographic technique developed to determine Pt and Pd in the common sulfides pyrite, pyrite; and in mixed arsenides, chief-pyrrhotite, pentlandite, and chalcoly niccolite, gersdorffite and maucherite, in ores of the Sudbury district. The method involves concentration by fire assaying and mixing the resulting beads with gold amalgam. Results of both qualitative and quantitative spectrographic analyses on various minerals. 15 ref. (S11, Pt, Pd)

192-S. Chromographic Contact Print Method of Examining Metallic Minerals and Its Application. David Williams and F. M. Nakhla. *Bulletin of the Institution of Mining and Metallurgy,* Apr. 1951; *Transactions,* v. 60, pt. 7, 1950-1951, p. 257-295.

The method serves mainly to determine the constituent elements of opaque metallic minerals in polished sections and in discrete grains. It localizes individual elements throughout the whole area of a polished surface and affords a rapid means of making complete qualitative analyses of metallic minerals, metals, and alloys. Describes simple contact-print method, also the electrographic modification, which is more rapid and provides prints of greater clarity and sharpness. Includes black-and-white and colored plates. (S11)

193-S. Progress in Gamma Radiography. *Atomics* (London), v. 2, Apr. 1951, p. 112-118.

Recent developments in equipment and films for the nondestructive inspection of castings and welds. (S13)

194-S. Turbine-Blade Inspection. *Aircraft Production,* v. 13, Apr. 1951, p. 105-106.

Application of Sheffield Precionnaire pneumatic-unit gaging system. (S14)

195-S. Surface Finish Standards for Roughness, Waviness and Lay, as Adopted by the Department of Defense. T. E. Cassey and J. W. Sawyer. *Machine Design,* v. 23, May 1951, p. 137-140. (S15)

196-S. Selection of Materials Must be Guided by More Than Conventional Tests and Data. H. W. Gillett. *Machine Design,* v. 23, May 1951, p. 154-158.

Based on a new book by the late Dr. Gillett. Some topics discussed are: service conditions; effects of design on behavior; combination of requirements; question of ductility; factors in selection; tests and specifications; and limitations set by conventional tests. 21 ref. (S22)

197-S. Die-Cast Rotor Studies. L. C. Packer and G. E. Monchamp. *Electrical Engineering,* v. 70, May 1951, p. 389. (A condensation.)

Die-cast rotors have many advantages over Cu cage rotors for induction motors, but they also have more possible defects, because of the nature of the process. Nondestructive test equipment utilizing an oscilloscope. (S13, Cu)

198-S. Metallurgical Activities at Aberdeen Proving Ground. *Metal Progress,* v. 59, Apr. 1951, p. 499-502.

Laboratory and field testing procedures for gun tubes, armor and projectiles. (S21, T2)

199-S. Metal Failures in Aircraft. W. B. F. Mackay and R. L. Dowdell. *Metal Progress,* v. 59, Apr. 1951, p. 518-522.

Various examples such as exhaust systems, sheet metal work, torquing of bolts and studs, engine mounts, and welded joints and suggested failure-control methods. (S21, T24)

200-S. Continuous Gas Analyzer Serves High-Pressure Stack. John de Piccolellis. *Steel,* v. 128, May 7, 1951, pg. 136, 138.

Use of thermal-conductivity type of instrument for continuous analysis of blast-furnace top gas. Includes high-H_2 alarm to give immediate warning of cut tuyeres, cooling plates, or other failures, which could introduce water directly into the furnace. (S11, D1, ST)

201-S. Light Metal Extrusion Die Pool for Aircraft Industry. *Light Metal Age,* v. 9, Apr. 1951, p. 11.

New program recently announced by the Air Materiel Command, USAF, Supply Div., represents an industry and Government agreement and is in effect a national aircraft-extrusion-die pool. The program is designed to eliminate bottlenecks in the aircraft and Al and Mg extrusion industries. It will provide a step toward standardization of extrusion dies and specifications used in the manufacture of aircraft for the U. S. Government, and prevent future duplication of such dies. (S22, F24, Al, Mg)

202-S. Photocolorimetric Method for the Analysis of Nickel in Nickel Plating Baths. Gilbert C. H. Stone. *Metal Finishing,* v. 49, Feb. 1951, p. 44-48.

Possible effect of other ions apt to be present in Ni baths on accuracy of the Ni determination was also investigated. Maximum error introduced did not exceed 3%. 12 ref. (S11, L17, Ni)

203-S. Visual and Optical Evaluation of Metal Surfaces. Helmut Thielsch. *Metal Finishing,* v. 49, May 1951, p. 54-61.

Second of a series on fundamentals of surface measurement. Classification of optical procedures. Microscopic examination, replica techniques, electron-microscope methods, sectioning methods, and interferometric studies. 15 ref. (S15)

204-S. Determination of Impurities in Electroplating Solutions. XXI. Traces of Pb in Zn Plating Baths. Earl J. Serfass and Mary H. Perry. *Plating,* v. 38, May 1951, p. 473-476.

Pb is separated from interfering ions by extraction with a CCl_4 solution of dithizone in the presence of KCN. After removal of excess dithizone with alkaline KCN, transmittance of the CCl_4 solution is measured and quantity of Pb present determined from a calibration curve. (S11, L17, Zn, Pb)

205-S. Dimensional Checking and Pressure Testing of Gray Iron Castings. Kenneth M. Smith. *American Foundrymen's Society,* Preprint 51-14, Apr. 1951, 5 pages.

Equipment used. (S14, CI)

206-S. Choosing Equipment for Nondestructive Testing. Carlton H. Hastings. *American Foundrymen's Society,* Preprint 51-15, Apr. 1951, 6 pages.

Four principal tests; radiography, magnetic-particle tests, penetrant tests, and ultrasonic or acoustical tests. Applicability of these methods and of nondestructive tests in general, with regard to the choice of test equipment. (S13)

207-S. A Method of Measuring Local Internal Temperatures in Solids. H. Dean Baker and E. A. Ryder. *American Society of Mechanical Engineers,* Paper 50-A-101, 1950, 9 pages.

Thermocouple technique subjected to laboratory tests, as well as to extensive service under industrial operating conditions. (S16)

208-S. Inspection, Processing, and Manufacturing Control of Metals by Ultrasonic Methods. Carlton H. Hastings and Seymour W. Carter. *American Society for Testing Materials,* "Symposium on Ultrasonic Testing", 1951, p. 14-61.

Summarizes available technical literature through 1946 on the subject of ultrasonics as applied to metals. Emphasizes detection of flaws. 342 ref. (S13)

209-S. Basic Principles of Practical Ultrasonic Testing. John C. Smack. *American Society for Testing Materials,* "Symposium on Ultrasonic Testing", 1951, p. 62-71.

Progress in instrumentation, available equipment, principles of operation, and applications, including setting up of test standards. (S13)

210-S. Ultrasonics in the Heavy Forgings Industry. James C. Hartley. *American Society for Testing Materials,* "Symposium on Ultrasonic Testing", 1951, p. 72-83.

Application of nondestructive ultrasonic testing in the forging field. (S13, F22, ST)

211-S. The Application of Ultrasonics to the Fabrication of Aluminum. J. V. Carroll. *American Society for Testing Materials,* "Symposium on Ultrasonic Testing", 1951, p. 84-86.

Use of nondestructive ultrasonic tests with a Reflectoscope for determination of internal soundness of Al ingots, forging stock, forgings, and large rolled shapes. (S13, Al)

212-S. Ultrasonic Testing in Railroad Work. E. D. Hall. *American Society for Testing Materials,* "Symposium on Ultrasonic Testing", 1951, p. 87-89.

Experiences in testing locomotive axles with a Reflectoscope, to locate cracks. (S13, T23)

213-S. Ultrasonics in the Electrical Industry. D. M. Kelman. *American Society for Testing Materials,* "Symposium on Ultrasonic Testing", 1951, p. 90-101.

Testing of large steel forgings used in turbogenerator rotors. (S13, T25, ST)

214-S. Ultrasonic Testing of Bronze Forgings and Ingots. A. Piltch. *American Society for Testing Materials,* "Symposium on Ultrasonic Testing", 1951, p. 102-103.

Experience of the Naval Gun Factory in the use of the Sperry Reflectoscope. (S13, Cu)

215-S. Crankshaft Bearing Failures. P. H. Smith. *Australasian Engineer,* v. 44, Mar. 7, 1951, p. 68-69.

Influence of increased bearing clearances and higher lubricating oil pressures. (S21, SG-c)

216-S. Radiography of Welded Joints for Power Plants. J. H. Lawson. *Australasian Engineer,* v. 44, Feb. 7, 1951, p. 78-82.

Equipment and procedures. (S13)

217-S. The Inspector's Approach to Arc Welding. C. W. Ephithite. *Australasian Engineer,* v. 44, Mar. 7, 1951, p. 79-83, 103.

The inspector's program is outlined and reference made to the various types of joint and the kind of defects likely to be encountered. (S13, K1)

218-S. Some Applications of Interferometry to the Examination of an Electrodeposited Film. S. Tolansky. *Journal of the Electrodepositors' Technical Society,* v. 27, 1951, 8 pages. (Advance Copy 6.)

How multiple-beam interferometry can offer a means of studying electrodeposits. One variety of multiple-beam interference, and its use in determining surface contour, hardness indentations, thickness of deposit, and characteristics of a Sn-Ni deposit. (S15, S14, Sn, Ni)

219-S. Inorganic Chromatography on Cellulose; Some Applications to the Analysis of Nickel Plating Baths. F. H. Burstall, N. F. Kember, and R. A. Wells. *Journal of the Electrodepositors' Technical Society,* v. 27, 1951, 12 pages. (Advance Copy 11.)

A cellulose column separation process which enables a number of metals to be extracted together from a nickel plating solution. Gives previous methods and results of experiments. (S11, L17, Ni)

220-S. From a Metallurgist's Notebook: Stressed Brass Bases. H. H. Symonds. *Metal Industry,* v. 78, Apr. 27, 1951, p. 350.

Absence of any significant corrosion on brass lipstick bases which showed cracking in the walls ruled out the possibility that this failure was due to season-cracking. Results of examination indicate that the failure was due to stress cracking brought about by conditions which included hardness of the metal, circumferential tensile stresses in the walls, and pitted nature of the surface. Includes micrographs. (S21, Q27, Q29, Cu)

221-S. Production Problems. IV. Prematurely Broken Crankshaft. *Iron and Steel,* v. 24, May 1951, p. 179-180.

Examination of fractured steel crankshaft. Data, observations, and conclusions as to cause of failure. (S21, CN)

222-S. Spectrographic Determination of Aluminum, Zinc, and Silicon in Magnesium Alloys Containing 90% Mg. (In French.) Jean-Pierre Puenzieux. *Helvetica Chimica Acta,* v. 34, Mar. 15, 1951, p. 615-628.

An improved method characterized by rapidity, precision, and simplicity. Optimum conditions of operation and technique of determination. Typical data. (S11, Mg)

223-S. New Instruments for Magnetic Nondestructive Testing. (In German.) Werner Jellinghaus. *Archiv für das Eisenhüttenwesen,* v. 22, Mar.-Apr. 1951, p. 111-115.

Design and operation of three German instruments. (S13)

224-S. Certain Results of Investigation of the Surface Quality of Machine Parts. (In Russian.) P. E. D'yachenko. *Izvestiya Akademii Nauk SSSR* (Bulletin of the Academy of Sciences of the USSR), Section of Technical Sciences, Jan. 1951, p. 22-28.

Investigation undertaken to establish criteria for evaluation of surface microgeometry due to different kinds of cold working. Methods of evaluating three basic parameters most strongly influencing surface quality (roughness of the cutting edge, roughness of the tool, and radius of the cutting edge). Other factors influencing surface nonuniformity were also studied. Devices for determination of surface quality and fields of applicability. (S15)

225-S. A New Nondestructive Test for Corrosion-Fatigue Cracks in Drill Pipe. S. A. Wenk and H. M. Banta. *Oil and Gas Journal,* v. 50, May 17, 1951, p. 90-92, 125-126.

"Magnaglo" dry, fluorescent, magnetic powder and technique for interior inspection of tubular products. Practical information on use of the method in the field. (S13, R1, ST)

226-S. Improvements in Metallurgy and Design Reduce Failures of Drill String Tools. Frank Briggs. *Petroleum Engineer,* v. 23, May 1951, p. B7-B10, B12.

Contributions of metallurgy and design to the problem. Includes micrographs and macrographs. (S21, T28, AY)

227-S. Research Attack on the Shelly-Rail Problem. L. S. Crane. *Railway Engineering and Maintenance,* v. 47, May 1951, p. 441-443.

The wide incidence of the rail defect known as "shelly spots" comprises one of the most perplexing rail-failure problems facing the railroads today. In an effort to find a remedy for this condition, a large amount of research has been carried out on a broad front. Nature of this research and results to date. (S21, T23, CN)

228-S. Utilization of Ultrasonics in Control of Welding. (In French.) P. Bontron. *Soudure et Techniques Connexes,* v. 4, Nov.-Dec. 1950, p. 229-237; disc., p. 237-239, 247.

Three methods, with preference given to a resonance method. Development of a code for correlating oscillograph patterns and corresponding defects. (S13, K general)

229-S. (Book) **Standard Methods of Analysis of Iron, Steel, and Ferro-Alloys.** Ed. 4. 170 pages. 1950. United Steel Companies, Ltd., Publications Dept., 17 Westbourne Rd., Sheffield 10, England. 17 s., 6 d.

Includes developments in methods and technique since the 3rd edition (1945). The major addition is a new section dealing with physicochemical techniques, such as absorptiometric and polarographic methods. (S11, Fe, ST)

230-S. (Book) **Metal Spectroscopy.** F. Twyman. 569 pages. 1951. Charles Griffin and Co. Ltd., 42 Drury Lane, London, W.C. 2, England. 50s.

A new edition of "Spectrochemical Analysis of Metals" (1941) but with a considerable amount of additional matter. Scope has been enlarged to include descriptions of absorptiometric methods in the ultra-violet and infrared, X-ray diffraction methods, and some particulars of chromatographic separations. (S11)

231-S. (Book) **Symposium on Ultrasonic Testing.** 133 pages. 1951. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. (Special Technical Publication No. 101.)

Includes 10 papers by different authors, an introduction, and general discussion. Pertinent papers are abstracted separately. (S13)

232-S. (Pamphlet) **Bibliography on Industrial Radiology.** 3rd Supplement. Herbert R. Isenburger. 19 pages, 1951. St. John X-Ray Laboratory, Califon, N. J. $2.00.

Covers years 1948-50. (S13)

T

APPLICATIONS OF METALS IN EQUIPMENT

177-T. Peerless Gets 100% Greater Die Life With Harder Cores. Ralph L. Clark. *Western Metals,* v. 9, Apr. 1951, p. 35-36.

Change from a hobbing steel with carbon as low as 0.04% to a 4½% Cr air hardening hobbing steel resulted in improvement in life of dies for casting Zn alloy necktie clasps. (T5, E13, AY, Zn)

178-T. Stainless Steels in Pulp and Paper Equipment. H. O. Teeple. *Paper Industry,* v. 33, Apr. 1951, p. 52-54.

Application to mechanical sulfite, and sulfate pulping operations. Selection by corrosion resistant properties. (T29, R5, SS)

179-T. Progress in Polymetallic Plates. Herbert R. Leedy. *Modern Lithography,* v. 19, Apr. 1951, p. 35-39.

Ink repellance and attraction of different metal surfaces and the use of polymetallic plates in lithographic processes. Includes chart showing comparison of various metals for different processes. (T9)

180-T. Monument to Mankind. *Steel Horizons,* v. 13, spring, 1951, p. 14-15.

Use of stainless steel in new United Nations Headquarters building. (T26, SS)

181-T. This Heart and Lung Machine May Save Your Life. *Steel Horizons,* v. 13, Spring 1951, p. 16-17.

Apparatus for use in medicine and surgery. Emphasizes use of stainless steel. (T10, SS)

182-T. They Shoot With Silver Nitrate. *Steel Horizons,* v. 13, Spring 1951, p. 18-19, 27.

Use of stainless-steel developing tanks by Armed Forces combat photographers. (T9, SS)

183-T. Unusual Spring Alloy Solves Variable Temperature Problem. *Inco Magazine,* Spring 1951, p. 18-19, 27.

Use of Iso-Elastic alloy made by John Chatillon & Sons for instrument springs with low thermoelastic coefficient. (T8, Q21, Ni)

184-T. Tungsten Carbide Rolls for Cold Rolling Metals. R. T. Beeghly. *Iron and Steel Engineer,* v. 28, Apr. 1951, p. 74-78; disc. p. 79.

The above can be used at speeds double that of normal practice. Their use may require changes in operating practice such as amount of reduction, annealing cycle, roll shape, etc. (T5, F23, W, C-n)

185-T. Metallurgical Factors and Drill Collar Performance. R. J. Stoup. *Drilling,* v. 12, Apr. 1951, p. 30, 33.

Previously abstracted from *Oil and Gas Journal.* See item 154-T, 1951. (T28, ST)

186-T. Aluminum Windows for Canadian Weather. H. N. Acker. *Canadian Metals,* v. 14, Apr. 1951, p. 46. (T26, Al)

187-T. Producing Hollow Steel Propeller Blades for Aircraft. *Machinery* (London), v. 77, Apr. 5, 1951, p. 550f-550L.

Procedures and equipment of Hamilton Standard Div., United Aircraft Corp., East Hartford, Conn. Cores and shells are high-alloy steel. Operations include machining, hot forming, seam welding, sand blasting, and lacquering. (T24, G17, K general, L10, L26, AY)

188-T. Producing Parts for Nickel-Iron Storage Batteries. George E. Stringfellow. *Machinery* (London), v. 78, Apr. 12, 1951, p. 593-600.

Equipment and procedures of Thomas A. Edison, Inc. Rolling, forming, and other press operations; automatic gas seam welding, machining, spot welding, and plating are among the processes employed. (T1, G general, K2, K3, L17, ST, Ni)

189-T. High Temperature Steels and Alloys for Gas Turbines. *Engineer,* v. 191, Mar. 9, 1951, p. 313-314; Mar. 16, 1951, p. 312-313; Mar. 23, 1951, p. 352; Mar. 30, 1951, p. 380-381; *Engineering,* v. 171, Mar. 9, 1951, p. 282-283; Mar. 16, 1951, p. 312-313; Mar. 23, 1951, p. 352; Mar. 30, 1951, p. 380-381; *Aircraft Engineering,* v. 23, Mar. 1951, p. 78-82, 85; *Metallurgia,* v. 43, Mar. 1951, p. 119-126; **High-Temperature Steels; Symposium on Materials for Gas Turbines,** *Iron and Steel,* v. 24, Apr. 1951, p. 124-138.

Summarizes proceedings of Iron and Steel Institute Symposium. (T25, AY, SG-h)

190-T. Light-Alloy Supports. W. H. Evans. *Light Metals,* v. 14, Mar. 1951, p. 129-132; Apr. 1951, p. 172-180.

Some of the more important developments made in Britain during the past 5 years in application of Al alloys as roof supports in mines. (T28, Al)

191-T. Aluminium and General-Line Containers. *Light Metals,* v. 14, Mar. 1951, p. 139-147; Apr. 1951, p. 195-206. (Reprinted from *Aluminium Laboratories, Ltd.* (Banbury, England), Development Bulletin No. 12.)

Materials, plant techniques, and range of products. Concluding part: deep drawn containers and their fabrication. Includes impact extrusion of tubes and other containers. (T10, G5, Al)

192-T. Aluminium Fire Engine. *Light Metals,* v. 14, Apr. 1951, p. 180-181.

A fire engine in which Al construction has saved nearly a ton in weight. (T21, Al)

193-T. Magnesium Reflects 1851. *Light Metals,* v. 14, Apr. 1951, p. 184-185.

Re-creation in Mg alloy castings of the "Crystal Palace," originally built in 1851, using cast and wrought iron for intricate lacy arches and panels. (T9, T26, Mg)

194-T. Aluminium in Electrical Power Systems. (Concluded.) K. J. Smith. *Light Metals,* v. 14, Apr. 1951, p. 214-222.

Al conduit and Al-sheathed cable of different types. (T1, Al)

195-T. Minor Uses of the Light Metals. IV. Magnesium in Metallurgical Control. *Light Metals,* v. 14, Apr. 1951, p. 222-223.

Applications in refining of Cu and Ni. (T5, C21, Mg, Cu, Ni)

196-T. Fish-Storage Holds of Modern Trawlers. (In French.) Pierre Vidal. *Revue de l'Aluminium,* v. 28, Feb. 1951, p. 51-54.

Use of Al alloy sheets for lining trawlers, and their advantages. (T22, Al)

197-T. A Duralumin Bridge 95 Meters Long on the River Tummel. (In French.) Maurice Victor. *Revue de l'Aluminium,* v. 28, Feb. 1951, p. 56-57.

Bridge located in Scotland. Advantages of use of duralumin. (T26, Al)

198-T. An Extra-Thin Aluminum Watch. (In French.) *Revue de l'Aluminium,* v. 28, Feb. 1951, p. 59-60.

Watch designed by Swiss manufacturers. Most of the parts are of Al. (T9, Al)

199-T. Good Results With Duralumin in the Clock Industry; Duralumin Is Not Subject to "Oval" Wear and It Improves the Lubrication of Clock Movements. (In French.) Raoul Beyner. *Revue de l'Aluminium,* v. 28, Feb. 1951, p. 61-62. (T9, Al)

200-T. A Light-Alloy Protective Helmet. (In French.) R. Robart. *Revue de l'Aluminium,* v. 28, Feb. 1951, p. 63-64. (T2, Al)

201-T. Some New Applications of Light Alloys in Packaging and Bottling. (In French.) Pierre Prévot. *Revue de l'Aluminium,* v. 28, Feb. 1951, p. 65-71.

Restricted to Al and its alloys. (T29, Al)

202-T. Aluphot, A New Photographic Material. (In French and German.) Max Schenk. *Aluminium Suisse,* Mar. 1951, p. 61-63.

A new photographic process, in which the plate consists of Al coated with Al_2O_3 intermixed with Ag or Ag compounds and made light-sensitive by dipping in cold solutions. (T9, Al)

203-T. Aluminium Coins. (In French and German.) *Aluminium Suisse,* Mar. 1951, p. 64-65.

Trend toward use of Al and its alloys for coins. Examples from France, Italy, Rumania, Czechoslovakia, and other countries. (T9, Al)

204-T. Chromium Plated Light Metal Cylinders. (In German.) P. Riekert and W. Hampp. *Metalloberfläche,* v. 5, sec. A, Mar. 1951, p. 33-37.

Experiences with different unprotected and protected light-metal cylinders. Experiments show that hard-Cr-plated cylinders greatly reduce the wear of the cylinder as well as the piston. Best results were obtained with the alloy "Hydronalium". 17 ref. (T25, Q9, L17, Al, Cr)

205-T. Aluminum Conductors From an Aircraft Manufacturer's Viewpoint. W. W. Schumacher. *Transactions of the American Institute of Electrical Engineers,* v. 69, pt. 2, 1950, p. 1335-1341.

See abstract of condensed version in *Electrical Engineering,* item 496-T, 1950. (T1, T24, Al)

206-T. Cold War Puts Heat on Metal Powder. John Kolb. *Iron Age,* v. 167, May 3, 1951, p. 95-99.

The shortage of Cu, together with this metal's relatively low melting point, has spurred the Ordnance Corps' interest in iron powder rotating bands for shells. This could prove a boon to the powder-metallurgy industry and its customers, present and potential. Methods of production. (T2, H general, Fe)

207-T. Gears. Kenneth N. Mills. *Machine Design,* v. 23, May 1951, p. 116-120.

Methods for improving the resistance of heavy-duty gearing to service damage. Various lubrication, wear, corrosion, design, stress, and mechanical-property factors. (T7, Q general)

208-T. Designing an Electrical Appliance to Utilize Production Possibilities of Diecastings. G. H. Koch. *Machine Design,* v. 23, May 1951, p. 127-131.

As applied to an electric fan. A die-cast Al alloy is used for motor housings. (T10, E13, Al)

209-T. Realistic Detail by Die Casting. *Die Castings,* v. 9, May 1951, p. 21-22, 71.

Use of Zn-alloy die castings for combination cigarette dispenser and coin bank. (T10, E13, Zn)

210-T. Stop-Off Core Gives Production Flexibility. *Die Castings,* v. 9, May 1951, p. 27-29.

Use of Zn-alloy die castings in hand-control brake valves for trucks. (T7, Zn)

211-T. Safety Assured. *Die Castings,* v. 9, May 1951, p. 30-31.

Use of Zn-alloy die castings in safety containers for flammable and combustible materials. (T10, Zn)

212-T. Special Hardware for Folding Door. *Die Castings,* v. 9, May 1951, p. 32-33, 70.

Use of Zn-alloy die castings. (T6, Zn)

213-T. Die Castings Meet Requirements for Signal Corps Contract. J. Ross. *Die Castings,* v. 9, May 1951, p. 34-36, 60.

Use of Al die castings and stampings for case of portable a.c.-d.c. vacuum-tube voltmeter. (T1, Al)

214-T. Lead-Alloy Power-Cable Sheath. Herman Halperin and C. E. Betzer. *Electrical Engineering,* v. 70, May 1951, p. 415-420.

Newly developed arsenical Pb alloys for sheathing of underground power cables were found to be superior to Cu alloys in the following respects: resistance to bending caused by thermal expansion, resistance to creep caused by internal pressures, and fracture life under tensile stress. (T1, Q general, Pb)

215-T. Modern Trends in Airframe Materials. Leo Schapiro. *Metal Progress,* v. 59, Apr. 1951, p. 511-515.

Trends over the past ten years. Tomorrow's needs. Mechanical properties of some new alloy steels and of Ti and one of its stronger alloys. (T21, Q general, AY, Ti)

216-T. High-Temperature Problems in Aircraft Jet Engines and Turbo-Superchargers. R. B. Johnson. *Metal Progress,* v. 59, Apr. 1951, p. 503-510.

Parts discussed are the combustion-chamber liner, the nozzle diaphragm partition, the turbine buckets; the tail cone on the jet engine; and the nozzle box, the nozzle diaphragm, the turbine wheel, and turbine buckets on the turbo-supercharger. Physical and mechanical properties of various metals and alloys; defective pieces are illustrated. (T25, P general, Q general, SG-h)

217-T. Ductile Iron Replaces Alloy Gear Castings, Forgings. J. D. Sheley. *Iron Age,* v. 167, May 10, 1951, p. 99-100.

Ductile iron has been found to be an excellent substitute for alloy steel castings and forgings in paper machinery gears and other components. Heat treating gives tensile strengths up to 216,000 psi. and hardness over 400 Brinell. (T7, Q27, Q29, CI)

218-T. Design and Manufacture of Pressure Vessels. *Petroleum,* v. 14, May 1951, p. 127-130, 143.

Manufacturers' and users' views on British Standard 1500/1949. Welding, plate bending, and radiographic inspection equipment. (T26, ST)

219-T. Tungsten Carbide and the Defense Program. M. L. McCormack. *Mining Congress Journal,* v. 37, Apr. 1951, p. 110-111.

Cost and materials savings made possible by use of the tungsten carbide in mining drill bits. (T28, W, C-n)

220-T. How Modern Stamping Techniques Can Help Conversion. James M. Leake. *Finish,* v. 8, May 1951, p. 23-26, 84.

Advantages of stamping. Various examples of stamped metal parts for military and nonmilitary applications. (T2, G3)

221-T. Magnesium in the World's Largest Bomber. *Magazine of Magnesium,* May 1951, p. 4-7.

Various uses in the B-36. (T24, Mg)

222-T. Aeronautical Research and Development Trends. Frederick R. Dent, Jr. *Magazine of Magnesium,* May 1951, p. 10-15. (Excerpts from address by Frederick R. Dent, Jr.)

Emphasis on uses of Mg and its alloys. (T24, Mg)

223-T. Farm Implements of Welded Construction. Colin Spencer. *Welder,* v. 19, Oct.-Dec. 1950, p. 75-79. (T3, K general)

224-T. Aluminium in Electrical Power Systems. K. J. Smith. *Light Metals,* v. 14, Feb. 1951, p. 73-79; Mar. 1951, p. 158-164; Apr. 1951, p. 214-222.

World-wide illustrated review. (T1, Al)

225-T. The Light Alloy Bow. A. J. Hipperson. *Light Metals,* v. 14, May 1951, p. 227-229.

Advantages for use in archery. (T10, Al)

226-T. All-Welded Brewery Vats. *Light Metals,* v. 14, May 1951, p. 229-231.

Use of Al alloys. (T29, Al)

227-T. Aluminium at the British Industries Fair—1951. *Light Metals,* v. 14, May 1951, p. 233-267.

Enumeration, classification, and description of plant and equipment of interest to suppliers and users of light and ultra-light alloys in all forms. Pure applications of the metals are dealt with under one common subsidiary grouping. Actual users of the metals are indicated. (T general, Al, Mg)

228-T. Parlanti Process. Conrad Parlanti. *Light Metals,* v. 14, May 1951, p. 270-272.

Development of Al molds for casting irons and steels. Advantages of this material over conventional materials. (T5, E12, Al, CI)

229-T. Summary of the Advantages of Light Alloy Connecting Rods in Automobile Engines. (In French.) René Calais. *Revue de l'Aluminium,* v. 28, Jan. 1951, p. 12-16.

Advantages of weight reduction and improvement in mechanical efficiency. (T21, Al)

230-T. Weight Reduction of Mine Skips and Cages All Over the World.

(In French.) Jean Reinhold. *Revue de l'Aluminium,* v. 28, Jan. 1951, p. 23-27.
Use of Al alloys in France, Germany, South Africa, and the U. S. (T28, Al)

231-T. Service Life of Light-Alloy Parts Used in the Construction of Freight Cars. (In French.) Jean Hérenguel. *Revue de l'Aluminium,* v. 28, Mar. 1951, p. 89-93.
Superior performance, as compared with ferrous metals. (T23, Al)

232-T. Light Yachting and Light Metal. (In French.) Th. De Saint-Pere. *Revue de l'Aluminium,* v. 28, Mar. 1951, p. 94-96.
Advantages of light metals for construction of small yachts. (T22, Al, Mg)

233-T. Commercial Vehicles (Trucks) in 1950. (In French.) Maurice Victor. *Revue de l'Aluminium,* v. 28, Mar. 1951, p. 97-101.
Emphasis on applications of Al and its alloys. (T21, Al)

234-T. Beryllium Copper Shoulders Defense Jobs. John T. Richards. *Steel,* v. 128, May 14, 1951, p. 83-84.
High-strength alloy in the form of castings, strip and wire is finding many military-equipment applications, particularly in control devices and instruments. (T8, T2, Cu)

235-T. Metallurgical Factors Affect Drill Collar Performance. R. J. Stoup. *Steel,* v. 128, May 14, 1951, p. 90, 92, 94, 97.
Previously abstracted from *Oil and Gas Journal.* See item 154-T, 1951. (T28, ST)

236-T. New Roofing Material Used on the South Bank Exhibition Site for the Thameside Restaurant. *Sheet Metal Industries,* v. 28, May 1951, p. 462.
The material used is an aluminum cork sandwich insulated panelling. This material is claimed to have several advantages. (T26, Al)

237-T. Steel Supports in Mines. (In German.) Karl Gross. *Berg-und Hüttenmännische Monatshefte,* v. 96, Mar. 1951, p. 42-49.
Regardless of initial cost, longer life and possibility of reuse makes steel a more economical material than wood for this purpose. (T28, CN)

238-T. The State of the Art of Utilizing Rhenium Metal and Its Alloys. (In German.) W. Kleese. *Metall,* v. 5, Apr. 1951, p. 155-156.
Present and proposed uses. (T general, Re)

239-T. (Book) **Jet Aircraft Power Systems.** Jack V. Casamassa, editor. 338 pages. 1950. McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18.
Traces the history and development of the jet: its design, theory, and operation, including service, maintenance, and inspection. Includes chapter on materials for gas-turbines. (T25)

V

MATERIALS
General Coverage of Specific Materials

63-V. Versatile Aids to Industry. *Inco Magazine,* v. 24, Spring 1951, p. 8-10, 32-33.
Properties of the Pt metals and alloys. How they increase plant capacity, control quality, and prolong equipment life. Applications. (T general, Pt, EG-c)

64-V. Cobalt. J. Lomas. *Mine & Quarry Engineering,* v. 17, Apr. 1951, p. 128-130.
The various Co minerals and deposits, metallic and nonmetallic uses. (T general, B10, Co)

65-V. Manipulation of Corrosion and Heat-Resisting Steels. Part II. J. A. McWilliam. *Welding & Metal Fabrication,* v. 19, Apr. 1951, p. 133-139.
Hot forging and drop stamping; heat treatment; hot dishing and flanging; use of jigs for welding 18-8 steels; finishing operations; and grinding and polishing. (SG-a h)

66-V. Characteristics, Limitations, and Applications of Malleable Iron Castings. Harry A. Schwartz. *Foundry,* v. 79, May 1951, p. 102-103, 236-239.
From the point of view of the malleable founder and of his customers. (CI)

67-V. A Review of Beryllium and Beryllium Alloys. John T. Richards. *Journal of Metals,* v. 3, Mar. 1951, p. 379-386.
Extraction and production processing, physical and mechanical properties, structure and transformations, applications, etc. 91 ref. (Be)

68-V. Fabrication of Titanium. *Light Metal Age,* v. 9, Apr. 1951, p. 14-15.
Weldability; forgeability; rolling quality; formability; heat treatment; descaling; melting and casting; machinability; swaging; handling; and commercial quality. (Ti)

69-V. Lithium: Lightest Light Metal—Progress and Review. Samuel Hoffman. *Light Metal Age,* v. 9, Apr. 1951, p. 19-20.
(Li)

70-V. Some Notes on the Aluminium Bronzes. David D. Stead. *Australasian Engineer,* v. 44, Mar. 7, 1951, p. 44-51.
History, structure, types of alloys and effect of additions, physical properties, heat treatment and its influence on structure and properties, corrosion resistance, casting—recommendations and troubles, cold working, joining, machinability, applications, and future possibilities. 22 ref. (Cu)

71-V. Ductile Cast Iron. P. Markwell. *Australasian Engineer,* v. 44, Mar. 7, 1951, p. 61-65.
An illustrated review. (CI)

72-V. Minor Uses of the Light Metals. V. Titanium in Alloy Steel. *Light Metals,* v. 14, May 1951, p. 268-270.
(Ti, AY)

73-V. Commerical Uses of Zirconium Developing. G. L. Miller. *Iron Age,* v. 167, May 17, 1951, p. 83-87.
Because American Zr production all goes to AEC, the English have been the first to supply the metal to industry. Modified Kroll process for sponge production used by Murex, Ltd., Rainham, England. Properties, fabrication and applications. (Zr)

74-V. Advances in Metals. *Product Engineering,* v. 22, May 1951, p. 158-161.
New developments in alloy steels, Al, Mg-base alloys, Ti, and less common metals. Applications and properties are emphasized. (AY, Al, Mg, Ti, EG-b)

Lindberg Opens Georgia Office

Lindberg Engineering Co., Chicago, manufacturers of heat treating furnaces and melting furnaces, announces the opening of a direct factory sales office in Atlanta, Ga.

Philip J. Duffy will be moved from Chicago to take charge of this office, which will cover the states of Georgia, Alabama, Mississippi and Florida.

EMPLOYMENT SERVICE BUREAU

The Employment Service Bureau is operated as a service to members of the American Society for Metals and no charge is made for advertising insertions. The "Positions Wanted" column, however, is restricted to members in good standing of the A.S.M. Ads are limited to 50 words and only one insertion of any one ad. Address answers care of A.S.M., 7301 Euclid Ave., Cleveland 3, O., unless otherwise stated.

POSITIONS OPEN

Midwest

ENGINEERS: Immediate openings available to several young (25-27), single, mechanical, technical or metallurgical engineers with sales aptitude. Opportunity to work directly with head of established manufacturer of chemicals and equipment in customer and prospect contact and service. Give complete information including training and experience. Employment will be east of Mississippi River. Box 6-5.

METALLURGIST: Excellent opening in well known laboratory engaged in ferrous and nonferrous metallurgical research. Applicant should be college graduate in metallurgy and have at least five years experience, some in research. Age 26-32. Please furnish all details of education and experience along with expected salary and photograph. Box 6-10.

GRADUATE METALLURGIST: Under 35. At least five years experience in stainless and alloy steels, preferably in tube manufacturing. Laboratory metallurgical investigation with modern equipment. Opportunities for customer contact work. Excellent opportunity for right party with initiative and good personality and ability. In reply give full details as to experience, qualifications, salary and references. Box 6-15.

FOUNDRY SUPERINTENDENT: For shop producing 500 tons carbon and alloy steel, 300 tons electric iron and 150 tons brass pressure vessel castings per month. Must have extensive experience in foundry operations, proven administrative ability, good practical and technical background. Excellent opportunity with long established company of best reputation. Box 6-20.

RESEARCH METALLURGISTS: Excellent openings for metallurgists with interest and knowledge of modern research methods in fields of foundry, welding and heat treatment. Prefer men with advanced college training but not essential. Should be able to initiate and execute overall research program. Excellent opportunity for advancement in growing organization. Metals Dept., Armour Research Foundation, Chicago 16, Ill.

METALLURGIST: Required by manufacturer of aircraft engine parts in central Indiana. Graduate with four or five years experience in this field. Salary in proportion to ability and experience. The program is expanding and the position may lead eventually to supervision. Box 6-25.

SALES ENGINEER: Experience and knowledge of heat treating and metallurgy desirable but not necessary. Give training, experience and other qualifications. Territory already well established in and around Cleveland. Box 6-30.

METALLURGIST: Man to teach ferrous physical metallurgy on undergraduate and graduate levels. Holder of Ph.D. preferred. Rank and salary open. Box 6-35.

See also Box 6-130 "East"

East

METALLURGICAL GRADUATE: Recent graduate trained in physical metallurgy for an opening in the research laboratory of a large manufacturer of alloy, tool and stainless steels. Some training in X-ray diffraction desirable. In reply provide usual details including draft status, salary expected. Box 6-40.

METALLURGIST: For development and control work in nonferrous process metallurgy of special alloys. Several years experience in metal casting, rolling, heat treatment and associated operations required; sound background in physical metallurgy. Give complete details regarding experience, education, references, salary desired and preference of location—New York City or Cincinnati. Some travel. Box 6-130.

METALLURGIST: Manufacturer of small high-speed mechanisms requires recent graduate or graduate with 4 or 5 years experience in process control, including carburizing, nitriding and heat treatment of ferrous parts. Some knowledge of properties and processing of nonferrous materials desirable. New York State. Give education, experience and salary required in reply. Box 6-135.

Government

PHYSICAL SCIENCE AIDES IN METALLURGY, ENGINEERING AIDES IN MECHANICAL ENGINEERING: Positions open at various locations in and around Washington, D. C. Persons appointed will carry on subprofessional technical and scientific work. Rating and pay depending on experience and education. College degree not necessary but total and specialized experience must have been within related fields. Apply: U. S. Civil Service Commission, Washington 25, D. C.

INFORMATION SPECIALIST: For research, planning and writing Atomic Energy Commission semiannual and special reports. Advanced knowledge of technical subject matter, ability to deal with and elicit cooperation from technical people, considerable writing skill with six or seven years experience desired. Background in almost any technical writing field and experience with patterns and methods of work in Government agencies necessary. Pay depending on experience and qualifications. Employment would be in Reports Branch, Information Services Div., Washington, D. C. Write: c/o A. F. Thompson, Chief, Technical Information Service, U. S. Atomic Energy Commission, Washington, D. C.

POSITIONS WANTED

STEEL MILL TRAINEE: June graduate would like to secure industrial experience, preferably in steel mill. M.S. in metallurgy from Stanford University. Experience includes one summer in steel mill and laboratory assistantship at college. Box 6-45.

PHYSICAL METALLURGIST: Ph.D. Twenty years experience in metallurgical research and industry. National reputation, creative ability, publications, supervisory experience, foreign languages. Knowledge of metals both from producer's and consumer's side. Employed as chief metallurgist, desires more responsible position as chief metallurgist, metallurgical laboratory head or research director. Will consider teaching, consulting work or technical writing. San Francisco Bay Area only. Box 6-50.

METALLURGICAL ENGINEER: M.S. degree. Married, age 25, veteran. Experience includes 1½ years process metallurgist in the research, development and production of ductile titanium, one year as instructor in ferrous physical metallurgy and testing of engineering materials. No geographic preference. Box 6-55.

CHIEF METALLURGIST or SPECIAL ASSISTANT TO MANAGEMENT: Former chief metallurgical engineer and director of research with 25 years sound experience, now consulting for several firms, desires to become affiliated on a full-time basis with one firm as chief metallurgist or special assistant to management. Wide experience in ferrous and nonferrous metallurgy, foundry practice, machinability, heat treatment, metal processing. Box 6-60.

RESEARCH and DEVELOPMENT METALLURGIST: Age 34. Broad experience in rolling mill, openhearth, research and development in all types of low alloy, stainless and tool steels. Prefer Pittsburgh area. Box 6-65.

METALLURGICAL ENGINEER: Age 34. Experience includes ten years in research laboratory and last five years in charge of melt shop producing high-temperature turbojet alloys. Thoroughly familiar with new processes. Can offer fresh vital ideas. Desires position with production or research department in executive capacity. Box 6-70.

METALLURGIST, FOREIGN SERVICE: B.S. degree. Age 27, married, veteran, one child. Experience includes development, processing, consumer relations and original research in foundry industry. Interested in employment outside the United States or Canada. Box 6-75.

More Employment Listings on Page 54

EMPLOYMENT SERVICE BUREAU

(continued from page 53)

METALLURGICAL ENGINEER: Sixteen years experience in iron, steel and special alloys foundries. Comprehensive experience in iron and steel castings, openhearth, air, electric and induction furnace metallurgy. Qualified to head metallurgy department, superintend foundry, head research or technically assist executive. Box 6-80.

METALLURGIST: M.S. degree. Veteran. Age 32, married, two children. Nine years experience in research and production in steel foundry, heat treatment and welding problems. Familiar with customer complaint investigations. Interested in responsible position which demands initiative, technical ability and judgment in ferrous research or production. Box 6-85.

METALLURGIST: Graduate with credits toward M.S. degree. Married, veteran, two children. Age 26. Experienced in wire drawing, roll forming, alumilite process, corrosion research, nonferrous. Familiar with liaison between development and research. Thesis work on recrystallization. Desires position in metal working industry in production or research. Midwest preferred. Box 6-90.

METALLURGIST: Experienced in plant supervision. Interested in metallurgical development or process development work with a progressive organization. Age 38, married, three children. B.S. degree in chemical engineering. Post graduate work in physics, metallurgy and labor economics. Considerable experience with centrifugal casting of gray iron. Box 6-95.

METALLURGICAL ENGINEER: Age 36, married. Fourteen years experience in ferrous metallurgy including gray iron, malleable iron and steel foundries. Excellent background in wrought steels including research and development along with practical experience in their fabrication and heat treatment. Desires position of top responsibility. Box 6-100.

METALLURGIST: B.S. degree. Family man. Age 32. Desires permanent position as metallurgist for fabricating concern in Cleveland-Pittsburgh area. Over six years diversified metallurgical experience in ferrous and some nonferrous fabrication includes research, development and plant metallurgy covering hot and cold forming operations, welding and heat treatment. Box 6-105.

METALLURGICAL ENGINEER: M.S. degree. Age 28, married. Wishes responsible position in industry. Six years experience in industry and research including heat treatment control, plating, fabricating and vacuum melting. At present holding position as plant manager. Will travel. Box 6-110.

METALLURGIST: Graduate. Age 32. Cost conscious, agressive, 1½ years general steel mill experience. Currently employed by large manufacturer of mechanical and electrical products in laboratory on design and production metallurgical problems, specification writing. Desires responsible position in manufacturing or metal producing concern. Will relocate, travel. Box 6-115.

RESEARCH METALLURGIST: Age 30, married. B.S. chem. engineering; M.S. met. engineering. Four years experience fundamental research on mechanical properties, transformations, crystal growth processes. Author of several papers. Currently employed by leading eastern laboratory; will relocate—midwest preferred. Capable of directing research efforts of others. Minimum salary $6500. Box 6-120.

OPENHEARTH TECHNICIAN: Age 41. Experience includes metallurgical control in making, treating and delivery of various steels, plus six years foreign field. Prefer reorganizing O.H. pit practice, including selection of refractories plus new pouring methods and equipment. Has proven drawings developed abroad which can be utilized to lower costs and improve quality. Box 6-125.

Louisville Entertains Ladies

Reported by W. B. Moore

Technical Service Engineer
Reynolds Metals Co.

The annual Ladies' Night——the one social event of the year for the Louisville Chapter A.S.M.—was held May 1 at Kapfhammer's Party House. Following a steak dinner and election of officers, a "Pop the Question" quiz show was conducted by the popular television stars, Rosemary Reddens and Bob Kay. Several valuable prizes were awarded.

Next on the program was Joe Creason, talented feature writer for the *Courier-Journal* and *Louisville Times,* who spoke most entertainingly of his experiences over the State of Kentucky. Finally, young Bobby Lewis of Hodginsville, Ky., sang and played his guitar.

Zapffe Speaks on Stainless

Reported by A. F. Mohri

Chief Metallurgist
Steel Co. of Canada, Ltd.

The regular meeting of the Ontario Chapter A.S.M., on Feb. 2 in Hamilton, heard an outstanding lecture by Carl A. Zapffe, consulting metallurgist of Baltimore, Md. Details of Dr. Zapffe's talk on "Stainless Steels" have been reported in previous issues of *Metals Review.*

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